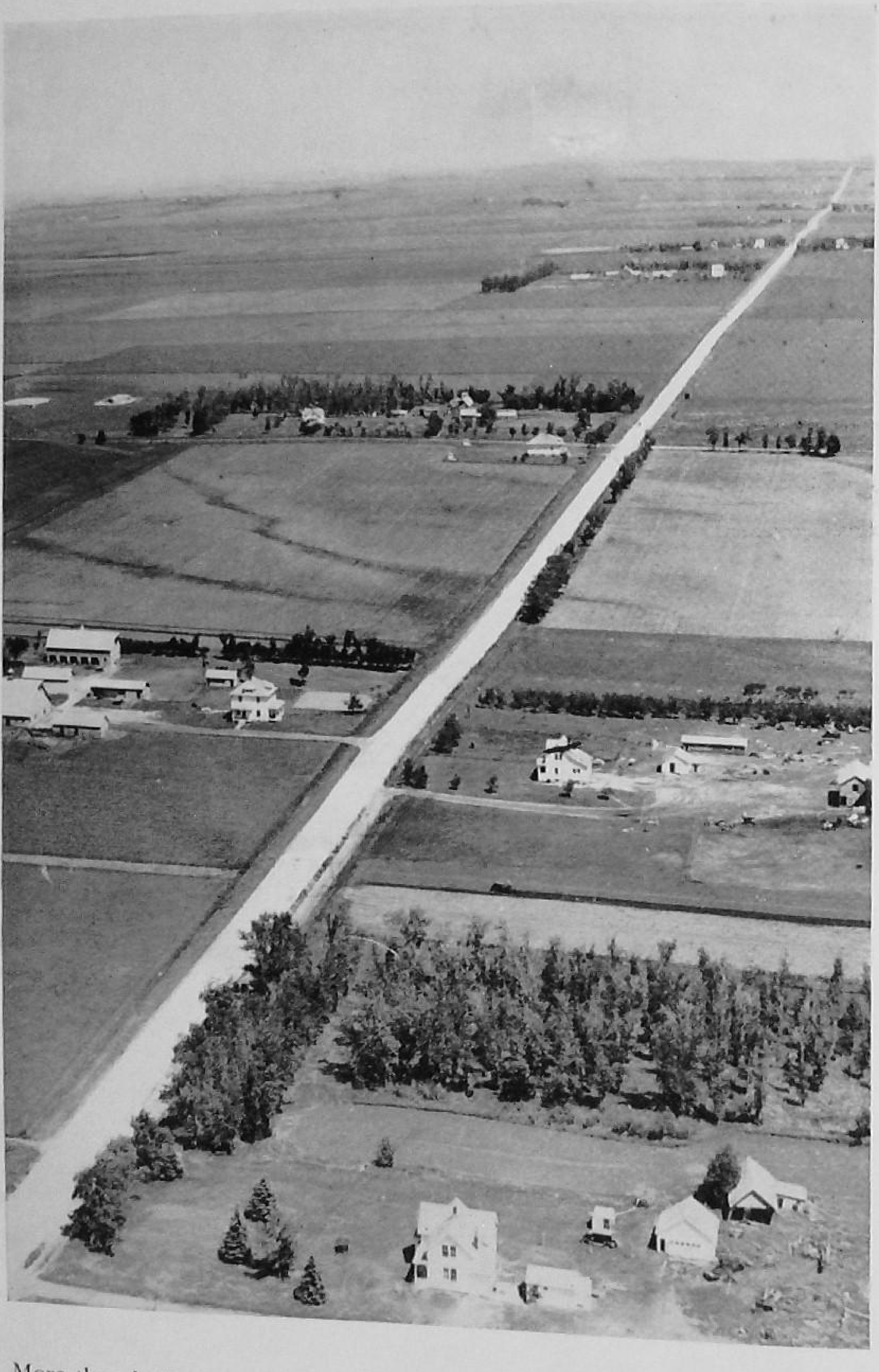
MODERN FARM MANAGEMENT

Principles and Practice



More than half (55.7 per cent) of the land in the United States is used for farming. Its productivity depends, to a large extent, on the skillful and judicious operation and management of the farmers who use the land. Courtesy S. D. State College.

MODERN FARM MANAGEMENT

Principles and Practice

By

ANDREW BOSS, D. Sc.
Late Professor of Agriculture
and Farm Management
University of Minnesota

and

GEORGE A. POND, Ph.D.
Professor of Agricultural Economics
University of Minnesota

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PREFACE

FARMING in the twentieth century is not the easy-going, carefree vocation that it appears to be from the outside. Neither is it as free from outside influences as it was in the days when the objective was primarily to provide for family needs. Commercialized agriculture as practiced currently is highly competitive, and conducted, for the most part, under great pressure. To be successful in present-day farming requires a wide range of knowledge of the life and growth habits of plants and animals, and the economics of agriculture and the business world.

In the preparation of this book the authors have attempted to develop the background upon which successful farming is founded, and to present in concise form an orderly discussion of the many problems and procedures involved in acquiring, organizing, and operating a farm. Material not hitherto available in text form has been included to supplement and complete the information required for successful operation of a farm business.

The text has been prepared for use in a general course in farm management. The authors believe it to be suitable for use as a college text book or as a final course in farm management in a vocational high school. The subject matter of the text has been used for many years by the authors in teaching farm management. It is based upon and supported by the results of a wide range of research in many states and by various agencies, including the Department of Agriculture. While many of the data presented and used in illustrating and working out the successive stages in organizing a farm business and in testing its efficiency are drawn from Minnesota farms, the methods and principles involved will apply as well in other states.

Although the book has been prepared primarily as a text, it is also suitable as a guide book for farmers, many of whom will profit by careful reading.

The authors have drawn upon published and unpublished source material. It is believed that credit has been given in footnotes and references where credit is due. The thanks of the authors are hereby expressed to all who have contributed in any

way in the preparation of the text. To Dr. S. A. Engene hearty appreciation is offered for the preparation of Chapter XXIV on Work Simplification.

Since the above was written Dr. Andrew Boss passed away. Fortunately the manuscript had been completed and he had read the proofs in galley form. His host of friends, however, deeply regret that he missed the satisfaction of seeing this book come off the press. It was his last and most comprehensive contribution to farm management literature and summarizes the developments of a field in which he was a pioneer and to which he devoted a lifetime of service. It was, in a sense, his valedictory to the subject of his major interest and activity for nearly fifty years.

The co-author received his training in farm management from Dr. Boss and was associated with him in teaching and research for more than 30 years. Even after his official retirement from the staff of the University of Minnesota in 1936, Dr. Boss maintained his contacts with his former associates in farm management and was very generous in giving them the benefit of his constructive vision, wise judgment, and rich and varied experience. The junior author welcomes this opportunity and privilege to acknowledge his personal and professional debt to the friend and mentor who guided and inspired his efforts for so many years. Especially does he wish to express his grateful appreciation of the privilege of sharing authorship of this book.

GEORGE A. POND

CONTENTS

		Page
Preface		*vii*

Introductory

I.	What Is Farm Management?	3
II.	History and Development of Farm Management	11
III.	Characteristics of Farming	23

Part I

ELEMENTS INVOLVED IN FARMING

IV.	Natural Resources in Relation to Farming	39
V.	Agricultural Production Areas	54
VI.	Economic Forces Modify Production Areas	71
VII.	Characteristics of Types of Farming	77

Part II

FARM ORGANIZATION

VIII.	Becoming Established in Farming	100
IX.	Principles of Soil and Crop Management Involved in Farm Organization	125
X.	The Place of Livestock in Farm Organization	148
XI.	Planning the Physical Organization of the Farm	160
XII.	Organization of the Farm Unit	170
XIII.	Mapping the Farm and Measuring Production	175
XIV.	Checking the Results	182

XV. Improving the Organization 192
XVI. Budgeting a Farm Business 198
XVII. Which Plan Promises the Best Return? . . 213

Part III

FARM OPERATION

XVIII. Principles of Farm Operation 223
XIX. Determining the Results from Operation . . 236
XX. Measures of Management in Farm Operation 242
XXI. Measuring the Efficiency of Operation . . 255
XXII. The Human Factor in Farm Operation . . . 268
XXIII. Shaping the Work Program 276
XXIV. Farm Work Simplification 286
XXV. Equipment for Economic Operation 301
XXVI. Producing Home and Farm Supplies 319
XXVII. Farm Marketing Problems 332

Part IV

FARM MANAGEMENT SERVICES AND RELATED PROBLEMS

XXVIII. Useful Farm Records 341
XXIX. The Use of Capital and Credit in Farming . 355
XXX. Farm Marketing Organizations 380
XXXI. Farm Management Services 415
XXXII. Planned Production Programs 420
XXXIII. Legal Matters Relating to Farm Business . . 433
Appendix 471
Index 487

ILLUSTRATIONS

		Facing page
Frontispiece.	Farm Land Panorama	Title
Plate I.	A Well-Developed Farmstead	52
Plate II.	A Typical Truck Garden	52
Plate III	Down in the Cotton Fields	53
Plate IV.	In the Hard Spring Wheat Region	53
Plate V.	Summertime in the Dairy Region	84
Plate VI.	A Representative Barn in the Dairy Region	84
Plate VII.	A Representative Corn Field Scene	85
Plate VIII.	Temporary Storage for Corn	85
Plate IX.	The First Stages of Soil Erosion	116
Plate X.	Conserving Moisture and Preventing Erosion	116
Plate XI.	An Example of Strip Cropping	117
Plate XII.	Farm Stock Water Ponds	117
Plate XIII.	Cattle on the Short-Grass Plains	148
Plate XIV.	Beef Cattle in the Feed Yard	148
Plate XV.	A Ranch Substation	149
Plate XVI.	Fat Cattle at a Terminal Market	149
Plate XVII.	An Elaborate Farm Unit	276
Plate XVIII.	Marketing by Truck	276
Plate XIX.	An Example of Productive Labor	277
Plate XX.	Machines Replace Man Labor	277
Plate XXI.	Producing Home Supplies	308
Plate XXII.	A Roadside Farm Market	308
Plate XXIII.	The Poultry House	309
Plate XXIV.	A Frozen-Food Locker	309

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CHAPTER I

WHAT IS FARM MANAGEMENT?

THE QUESTION raised in the heading of this chapter sounds like a simple one that can be easily answered. From an academic viewpoint it is. The U. S. Census recognizes a *farm* as "three or more acres of land operated as a unit, or a smaller unit that produced, in 1939, an income of $250 or more."[1] It implies that there are included such power, implements, buildings, and facilities as may be required for successful operation. The dictionary defines *management* as (1) the act or art of managing, or (2) judicious use of means to accomplish an end; skillful treatment. In academic terms, therefore, *farm management* means the act of judiciously and skillfully managing a farm. While the answer seems simple and complete, the fact remains that the skillful management of a farm is not a simple, but a complex task involving a wide range of knowledge and skills in many fields of the arts and sciences.

DEVELOPMENT OF THE TERM. The term *farm management* is a comparatively new one, as will be shown in Chapter II. It has come into use in agricultural circles in the last half-century during the transition from the old-time, self-sufficiency type of farming to the more modern commercialized type. The old type of self-sufficiency farming developed as an art through age-long experiences of farmers in which good practices, developed largely by trial and error, were passed on from father to son and neighbor to neighbor. As the biological sciences developed (largely within the last century), progressive farmers began to use the findings of science as tools in improving their art. The sciences of chemistry, botany, zoology, and physics have contributed much new knowledge which has been moulded into tools for use in the practices and arts of farming.

[1] U. S. Census Report, 1940.

As commercialized farming developed, farmers found themselves involved in selling and buying. This called for knowledge in the field of business. Farmers needed to know the values of their products as measured against the value of the products sought in exchange. They needed also knowledge of markets, transportation, distribution, and of supply and demand for their products. Farmers gained some of this knowledge by experience, dearly bought in some instances. Happily a new field of science, Farm Economics, developed almost entirely within the present century, began to supply facts, laws, and principles to be used by the farmer as additional new *tools* in improving the returns from his farming operations. Thus, instead of being the simple art it was thought to be a century ago, farming has become a vocation in which the arts, sciences, and business are all important factors. In the best and most modern sense, farm management is now not only an art, but a science and a business. To successfully manage a farm involves all three in the "judicious use of means to accomplish an end."

PRIMARY FACTORS IN FARM MANAGEMENT

As stated above, art, science, and business are all involved in the successful operation of a farm, which, in most instances in America, is a home as well as a place of business. To make successful use of the elements that enter into a business, one must have a thorough knowledge and understanding of each. It may be advantageous, therefore, to give some thought to the ways in which art, science, and business enter into and affect the operation of a farm unit.

Art and Farm Management. Farming has come down through the ages as an art acquired by the experiences of individuals in growing plants for food, for fibre to be used in making clothing or for other purpose, and in caring for animals that provided food articles or served as beasts of burden. Through repetition, observation, and study, certain skills were attained, and improved practices developed, which were preserved by tradition and passed on from generation to generation. In this way a body of knowledge was built up that served as the foundation on which the agricultural industry was built. As the art of printing was developed, the best farm practices were published in books and periodicals, widening the distribution and use of the arts and knowledge gained through the experiences of farmers.

The plain arts of the farm such as plowing the land, sowing

the seeds, harvesting the crops, reproducing the animals, feeding livestock, and milking cows are best learned by repeated every-day practice in performing such tasks. The mechanical work of the farm such as building fences, operating machines, and driving horses or tractors is also best learned by actually doing the work. That is why the boy who grows up on a farm can perform these tasks so much better than his city cousin who may have read much more about them but has not acquired the technic by doing them. That some farmers excel others in the neatness of their furrows, the straightness of their corn rows, the tilth of their soil, the quality of their crops, and the condition of their animals may be observed in any community. Certain skills which partake of the nature of art also grow out of much repetition of tasks related to the upkeep of the farm buildings, fences, and the home. These abilities have been acquired by practice and the experience that comes with doing. It is an expression of the *art* side of farming.

Skills so acquired become a part of the art of the farmer as expressed in the cultivation of his fields, the condition and performance of his livestock, and the appearance of his farmstead and buildings. The "eye of the Master that fatteneth the ox," the "twist of the wrist" and the "knack for doing work well" are familiar expressions of the importance of and appreciation of applied art. The acquisition of these arts comes only through repeated practice, thoughtful observation, and close study. The reward for a high degree of art in farming lies in increased income and in the satisfaction gained from work well done.

Science and Farm Management. It is often said that a farmer in these days must be a scientist. It does not follow that he is a scientist merely because he is a farmer. Whether he is or not depends on the extent to which he uses the findings of the sciences in the operation of his farm. Since the passage of the Hatch Act, by the United States Congress in 1885, enabling the organization of agricultural experiment stations in every state and providing financial support for them, a great body of knowledge has been built up in the sciences related to agriculture. The biological sciences of chemistry, botany, and zoology were the first to supply facts converted into organized and systematized knowledge which proved useful to farmers.

Scientists working in the field of chemistry supplied knowledge about the composition of soils and the values of manures and fertilizers used in crop production. They also analyzed feeds and compounded feeding rations which enabled farmers to get

better returns from the animals kept for milk or meat-producing purposes.

Botanists described and classified the plants making up the farm crops, and made available knowledge of the flowering and reproductive habits of many of them. Using the knowledge thus provided, others applied it in improving the quality and yield of crops through the science of plant breeding. Rust-resistant varieties of cereals, hybrid corn, and hardy varieties of alfalfa and fruits are examples of the results of biological sciences applied in the improvement of crops.

Scientists working in the branch known as zoology have in similar ways expanded the knowledge of animal life. Study of the cellular structure of body tissues and of the structure and functions of the reproductive organs, and of the laws of inheritance, has provided animal breeders with funds of knowledge which have led to great improvement in the breeds and classes of livestock raised by farmers.

There has been advancement also in knowledge gained in the field of the physical sciences. Electricity has been harnessed by scientists and inventors and now relieves the farmers who use it from some of the arduous tasks of the farm. Gas is available on many farms to make lighter the work and quicken the pace at which land can be prepared and crops secured.

Much more could be said about the contributions of the biological and physical sciences to the operation and management of farms. The foregoing discussion is sufficient, however, to illustrate the point that should be noted; namely, that science has provided a vast body of knowledge which can be useful to farmers only if applied *as tools* in increasing the production of plants and animals and improving the quality of the products. Using the knowledge gained from scientists does not make a farmer a scientist any more than using a razor to shave with makes a man a barber. Successful operation of his farm is still the prime objective. Instances may be cited in which farms operating on a large scale have set up laboratories and employed chemists to test the soils of their farms, and prescribe fertilizers suited to the needs of the various crops to be raised. There are other instances where farmers are employing the knowledge gained from plant scientists in producing hybrid corn or other improved crop plants. But these men primarily are farmers, not scientists, though they are using tools provided by scientists.

Business and Farm Management. Some writers contend that

farming is a business. It must be admitted that in the present day, when farms are operated so largely on a money economy, farming has much in common with business. The farmer must sell and buy, which necessitates business transactions. To buy and sell to advantage he should have knowledge of markets and of marketing regulations. It will be to his advantage to have knowledge of the geography of world production of agricultural crops and products. He should know about the channels of distribution and the competition for world trade in agricultural goods. He should also know about transportation lines and which will best suit his needs in disposing of his products. Information from the business side is important and vital in profitable farm operation.

Fortunately, scientists working in the field of agricultural economics have accumulated facts and knowledge about the economic forces that influence or control the movement of agricultural products into and out of national and world trade. Agricultural economists, following the methods of science, have discovered facts, formulated principles, and established laws of economics that prove valuable in organizing agricultural production as an industry, and in anticipating probable needs as expressed in what is commonly referred to as supply and demand. They are concerned chiefly with the flow of total agricultural products into and out of local, national, and international trade. They study the forces that affect the industry as a whole. Their interest lies in discovering the forces exterior to the individual farm that shape or influence the total agricultural production. This knowledge, like that provided by scientists in other fields, is useful to the operator or manager of a farm as a *tool* or *tools* in determining which lines of products that he can produce are likely to be in greatest demand, that will bring the greatest profit or best supply his own needs. But he does not become an agricultural economist because he uses knowledge or information provided by them as *tools* in planning his farm operations. Nor does he become a business man merely because he sells products from his farm and buys products from others. While he uses the knowledge of economists and the practices of business, his principal interest is in the management of his farm.

WHAT FARM MANAGEMENT IS

(Briefly and positively stated, farm management from the general agricultural viewpoint is the *act of managing a farm* or farm properties; from the viewpoint of education, it is *giving organ-*

ized instruction about the management of farms; from the viewpoint of research, it is *gathering, systematically recording, analyzing, and interpreting data relating to the details of organizing, managing, and operating specific farm units or properties.* In each of these areas of activity the focal point is, or should be, the individual farm unit or a group of farm units individually operated. It is always difficult to distinguish "farm management" from "farm operation" and the "farm manager" from the "farm operator." Farm management as an economic function consists essentially of planning and directing the operations of an individual farm from the viewpoint of maximum returns to the operator.

Improvement in the management of farms has come in reverse order to that given above in defining the term. It is through systematized, well-organized research that a fund of knowledge has been acquired about the organization and operation of individual farm units. The knowledge so gained is now widely used in classrooms by instructors in farm management, and by farmers and managers of farm properties in improving the income from farming. Thus science supports and expands the art of farming into the scientific management of farms. Slowly and surely farm management is advancing into the realm of the sciences. The scientific management of farms is finally becoming a reality.

WHAT THE FARM MANAGER DOES

The farm manager is primarily concerned with the selection of the factors of production, the choice and combination of enterprises, the determination of practices to be followed, the direction of labor, and the current and longer time adjustments that must be made in line with changing natural and economic conditions. He is not concerned directly with the problems of agriculture as an industry, or with the subject-matter sciences in the field of agriculture, although from the workers in these fields he draws the information that serves his planning processes. From them he obtains some of the tools with which he works. He must also be familiar with the "arts of agriculture" especially if, as is the rule in America, he is both operator and manager. This distinction between "farm management" and other fields of agricultural art and science is significant principally in delimiting and organizing research and teaching in farm management from an institutional viewpoint. In farming practice, art and science, management and operation, planning and performance, are inseparably blended.

The dictionary definition of management as the "judicious use

of means to accomplish an end" states briefly but definitely and precisely just what a farm manager is expected to do. The end that he is expected to accomplish is to so organize and manage a farm unit as to obtain from the enterprise the greatest and most continuous income and satisfaction. To accomplish that end he judiciously uses all the means available to him. Primary means are land, labor, and capital goods in the form of an equipped farm unit. Beginning with these, he exercises his organizing ability in having these so proportioned in combination as to give a well-balanced use of each. Then, such art and skills as he has acquired through practice and experience, and such judgment as he possesses, are employed in tilling his fields, selecting his crops, caring for his livestock, and directing available labor in the production of farm commodities. To the art he has attained, he adds the findings of the biological sciences, not as a biological scientist, but as a scientific manager of a farm. From the science of chemistry he may learn what his soils lack to provide abundant yields, and how to supply the needed elements. Through the "law of diminishing returns," as developed by the science of economics, he determines what amounts of nitrogen, or phosphorous or other plant food elements will most profitably increase the yields of his crops. From his own records, preferably, or from records supplied him from the findings of scientists in farm economics, he discovers which are the highest-profit enterprises of his farm unit. These he organizes into crop rotations or production systems that promise the greatest net earnings from the unit. To his farm operations he is now applying the findings of economic scientists, not as an economic scientist but as the scientific manager of a farm unit.

One can not long engage in farming before discovering that there are economic forces beyond the boundaries of his farm which greatly influence the income from it. Prices for farm products are paid, but not made, at the local market. World supply of, and demand for, a commodity, transportation and handling charges, all enter into making the price paid at the local market. Over these factors the farm operator or manager has no control. He must recognize and consider them, however, in organizing his production program. Again the economic scientists have conducted researches, and provided forecasts and outlook reports that are helpful in determining which commodities are likely to be in strongest demand and bring the most favorable returns. One who wishes to operate a farm profitably will use all such sources

of information so far as they be can applied, as tools in combining art, science, and business into scientific management.

Finally, the *function* of the farm manager is *to manage,* with double emphasis on *manage.* The *unit* of *management* is the *individual farm* or combined units of farm property. *Farm management* is the judicious use of all the known means of art, science, and business in the scientific management of a farm or of farm properties, with a view to securing the largest possible returns in income and satisfaction.

Chapter II

HISTORY AND DEVELOPMENT OF FARM MANAGEMENT

Farm management had its origins in the desires of farm operators and educators for greater knowledge of the principles that underlie successful farming as measured in security and good living standards. There are references to farm costs, to good farm practices, and to items of management scattered through agricultural literature from the time of the Romans to the settlement of America. Correspondence between some of the pioneer settlers of America and leading farmers of the British Isles and Europe, further illustrate this desire for more exact knowledge about the production of crops and animals and the management of farms. References to costs, profits, and management may also be found in the literature relating to early American farming. No attempt will be made here, however, to record the progressive development of agriculture through the ages. That is a task for the historians. Our desire is to describe as briefly and concisely as possible, the successive steps in American agriculture leading to the development of the educational subject-matter field now termed *Farm Management.*

DEVELOPMENT OF FARM MANAGEMENT IN THE UNITED STATES

The early settlers of America faced a gigantic task in replacing the forests of the Atlantic coast with dependable food and fibre crops, and in developing methods of farming which would give assurance of adequate supplies for the increasing population. Washington, Jefferson, and other prominent leaders of their time left records showing their interest in the development of agriculture and in the management of their landed estates. Others in later years continued the effort to find adaptable crops and livestock, to improve farm practices, and to establish farming, then the chief occupation of the masses, upon a stable and reliable basis. It was not until late in the nineteenth century, however, when some progress had been made in the development of the biological sciences, and the social sciences were beginning to take

form, that a beginning was made in the researches underlying scientific farm management. Science in the management of farms must be built upon facts established through the medium of accurate and continued research.

The Beginning of Research. There is no record of significant research in farm management before the passage of the Hatch Act in 1885, followed by the organization of state agricultural experiment stations, usually in connection with agricultural colleges. Note should be made, however, that cost studies were reported as early as 1845 by the U. S. Patent Office.[1] N. A. Weston of Illinois refers to inquiries concerning the cost of producing corn and oats in Illinois as reported by the State Board of Agriculture for 1886 and 1887.[2] He also refers to a questionnaire survey of 28,000 practical farmers made by the U.S.D.A. in 1893.[3]

The need for research in the field of farm management was first felt by the biologically trained agriculturists of the agricultural colleges, when faced with the necessity of developing courses in agriculture for students from farms or who expected to engage in farming. Agricultural literature was limited at the time, and confined largely to the fields of chemistry, botany, biology, and, to some extent, farm practices in raising crops and livestock. The fields of economics, statistics, and accounting which now serve farm management as useful tools were comparatively undeveloped at the time. The first efforts in research were turned toward learning the cost of crop production with a view to finding the crops most likely to yield a profit to those growing them and that could be worked into satisfactory combinations for profitable farming. Among those engaging in such studies were G. W. Curtis and J. W. Carson of Texas, who undertook a study of the cost of production, and profit per acre, in growing cotton, the results of which were published in March, 1893.[4] At the Nebraska Experiment Station, C. L. Ingersoll undertook a study of the cost of producing crops on the station farm. The results of this study were published in April, 1893.[5] B. C. Buffum of Colorado, in March, 1894, published a bulletin giving the cost of growing crops at that station.[6] These studies were of minor importance

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[1] G. W. Forster, *Farm Organization and Farm Management, 1938*, p. 28.
[2] *Bulletin 50*, Illinois Agricultural Experiment Station.
[3] *Ibid.*
[4] *Bulletin 26*, Texas Agricultural Experiment Station, 1893.
[5] *Bulletin 29*, Nebraska Agricultural Experiment Station, 1893.
[6] *Bulletin 17*, Wyoming Agricultural Experiment Station, 1894.

so far as results were concerned. They illustrate, however, the growing sense of need for more accurate knowledge of crop costs, and of the crop combinations most likely to yield satisfactory net income.

During this time, W. M. Hays of Minnesota, a colleague of the above-named workers in experiment station research, who often met them in national gatherings, was called from Minnesota to North Dakota in the fall of 1891 to organize the agricultural department of the North Dakota Experiment Station. In mapping the farm and laying out the experimental grounds, he provided for crop rotation trials on a scale that would give an opportunity for recording costs and studying the profits made from growing various of the cereal crops in rotation schemes. Hays remained at North Dakota only a year and a half and returned to Minnesota before data were available for publication.

One of the best attempts in pioneering studies of farm production costs was made by Weston of Illinois under the supervision of David L. Kinley in 1896. As with the earlier studies, the questionnaire method was used. Wherever possible, records were obtained of days of labor required for the operations in growing the crops, together with the rates per day or per hour for men and teams used. From these data, costs were calculated for the corn and oat crops. The results of this study were published in February, 1898.[1]

One can only speculate on the incidence of these studies. It seems reasonable to suppose, however, that they grew out of the economic distress that prevailed among farmers at that time, and that they were the result of attempts of experiment station men and college men to find a solution of the farmers' problems by discovering for them which of the crops it was most profitable to grow. These investigators were all college-trained men who were groping for methods of improving the financial position of farmers, and at the same time endeavoring to develop subject matter in farm management to teach to their college classes. While none of these investigations proved of great value in itself, they did serve as thought-stimulators and stepping stones to more effective attacks on the problem later.

THE BEGINNING OF FARM MANAGEMENT INSTRUCTION. I. P. Roberts of Cornell University, W. M. Hays of Minnesota, and Thomas F. Hunt of Ohio and Cornell may well be called the pio-

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[1] *Bulletin 50*, Illinois Agricultural Experiment Station.

neers in teaching farm management. Roberts, as early as 1874, began taking farm inventories of Cornell University farms, and later developed and taught a course in farm accounting. He was one of the first to recognize and teach management as a factor in successfully operating a farm. Hays, as an instructor in the Minnesota Secondary School of Agriculture, as early as 1894 offered a course in farm development in which students were required to map their home farms and develop plans for improvement and crop rotations, set up in such order as to make a well-balanced farm business. This course was later developed by Hays and Andrew Boss into a course in farm management in the Agricultural College.[1] While at Ohio State University in the late 1890's, Hunt offered a course in agricultural history, including public policy and farm management. Transferring to Cornell University in 1903, he developed this course into a primarily farm management course.

It may well be noted that the researches bearing on farm management and such teaching as was done in that subject prior to 1900, were initiated by men trained in the fields of general agriculture and agronomy who were anxious to build up a body of knowledge about farming that was based on well-established facts instead of rule of thumb.

In a review of the development of farm economics in 1931, Warren pointed out that in 1910 farm management was taught in the same department as agronomy, in twenty-five institutions.[2] In only three was it taught in departments of rural or agricultural economics. He commented further that "this development was logical and, I believe, fortunate. Of all the men working in agriculture the agronomists came nearest to seeing the farm as a whole. It was not a long step from crop rotations to cropping systems and from that to the farm as a whole (or unit)." . . . "One distinct advantage of this procedure was that it resulted in the immediate adoption of the scientific rather than the philosophical method of procedure. In the earlier days economics was primarily philosophy rather than science. The agronomists who went into farm management carried over their scientific methods at once into all their work."

A feature of farm management instruction has been that of following the laboratory method of using a farm unit as the basis for individual planning and class work.

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[1] See *Bulletin 125*, Minnesota Agricultural Experiment Station.

[2] G. F. Warren, *Journal of Farm Economics*, Vol. XIV, No. 1, p. 6.

ORGANIZED RESEARCH IN FARM MANAGEMENT. When Hays returned to Minnesota from North Dakota in the fall of 1893, he brought with him the idea of studying the cost of production of crops in connection with crop rotation studies to be made at the experiment station farm. During the winter of 1893-'94, Hays, in collaboration with Boss, then Assistant Agriculturist at the Minnesota Station, perfected plans for a group of forty-four one-tenth-acre rotation plots on the station farm which were to serve as a basis for discovering the best-paying systems of crop rotation and, at the same time, for studying the effect of the various rotations on soil fertility. Records were to be kept of the time required for the various operations in connection with each phase of crop production, and of the costs of seeds and materials used. At the end of the first five-year period, the conclusion was reached that this study was abortive and that it would not yield the desired information on the costs of crop production. The records of time employed in the crop production operations were overshadowed by overhead expense, and by gaps in the process of raising the crops and finding a market for the products. The discovery was made that there was no market for pasture, except through livestock, and no provision could be made for determining from the one-tenth-acre plots the returns from the land as measured in livestock products. While these rotation plots served a useful purpose in studies of the effect of rotation on the land, they proved useless as a basis for measuring relative costs of production and setting up profitable crop rotation plans.[1]

Attempts to use the information gained from the rotation plots at the station farm gave little satisfaction. Knowing that few farmers kept records of any kind in their farming operations, it seemed unwise to attempt to gain information through the questionnaire method, which had been tried in certain instances as described above. The conclusion was reached that if results of value were to be obtained concerning the cost of producing farm crops, the basic data for analyzing the problems and setting up sound farm management systems must be obtained direct from the farmers. Hays and Boss then set about the task of developing a method of getting such data from the farmers and of recording and analyzing the data. The next two years were spent in planning the attack and in finding financial support for what is conceded to be the first organized attempt in the United States to

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[1] For a discussion of this investigation, see *Bulletin 125*, Minnesota Agricultural Experiment Station.

learn the relative costs of producing various farm crops.[1]

STATISTICAL ROUTES ORGANIZED. During the summer of 1901, Hays, who was a traveling missionary for the cause, had interested Victor H. Olmsted, Chief of the Bureau of Statistics, U.S.D.A., at Washington, in an investigation of the costs of producing crops. W. J. Spillman, who had been Professor of Agriculture at Washington State College from 1894 through 1901, had become much interested in plant breeding research. Hays as a plant breeder had made the acquaintance of Spillman at national meetings, and Spillman had visited the plant-breeding nurseries at Minnesota. On January 1, 1902, he became Agrostologist of the Bureau of Plant Industry, U.S.D.A. While continuing to co-operate with Hays in plant-breeding research, Spillman became much interested also in the new attack being made by Hays in farm management research and became an earnest supporter of Hays in his quest for financial aid, later co-operating in developing this field of research.

With assured financial assistance from the Bureau of Statistics, Hays and Boss decided to establish so-called statistical routes at three points in the state, where farm cost data would be recorded from farms in active operation by farmers. In September of that year, they set out by team and platform spring wagon for Northfield, forty miles away in the heart of a good dairy farming area to solicit co-operation of farmers in providing reports of the daily transactions and activities connected with crop-growing on their farms. The plan of investigation called for placing a route man on the job who would visit each farm daily to pick up recorded reports or to interview the farmers and record data which were not readily available. Fifteen willing co-operators were found on a route of some ten or twelve miles in length, which was regarded as a suitable day's travel for the route statistician, with horse and buggy. Arrangements were made to initiate the work on January 1, 1902.

A similar route was set up in Lyon County, Minnesota, at that time thought to represent a diversified farming area. Another route was established at Halstad, Minnesota, in the Red River Valley, which, at the time, represented a highly specialized crop production area with spring wheat the leading crop. The thought was that, from the route at Northfield in Rice County representing the dairy type of farming, the one at Marshall, Lyon County,

[1] See *Bulletins 97* and *117*, Minnesota Agricultural Experiment Station.

representing diversified farming, and the one at Halstad in Norman County, representing grain farming, data would be secured from which there would be no difficulty in telling what types of farming would be most suitable and most profitable in any part of the state. On January 1, 1902, the Minnesota Agricultural Experiment Station, in co-operation with the Bureau of Statistics of the United States Department of Agriculture, began gathering data on the established routes. The work was directed entirely from the Minnesota Station with the expense being divided about equally between the Station and the Bureau of Statistics.

In the summary of objectives of the research, the authors indicate a primary interest in data that could be used in developing good management plans for the operation of individual family farms.[1] The aim was to find a basis for better farm organization and improved farm operation, and the development of information that would be useful to farmers and in teaching school and college classes in farm management.

The Office of Farm Management, United States Department of Agriculture, became active in the farm cost accounting studies in 1908 to 1910 and gave financial support to co-operative studies with the agricultural experiment stations in Minnesota, Ohio, Wisconsin and New York. It was at this time that Dr. H. C. Taylor, the first economist to become interested in farm management, began keeping cost records on his own farm and entered into a co-operative study of farm costs on a group of Wisconsin farms. There was another upsurge in this type of research in the Office of Farm Management and Farm Economics under the leadership of F. W. Peck and others during Dr. Taylor's service as Chief of the Office and later of the Bureau of Agricultural Economics, 1919 to 1926.

In 1912, the Illinois Agricultural Experiment Station, under the leadership of W. F. Handschin who had worked in the cost accounting office in Minnesota with Thomas P. Cooper, established a cost accounting route among the farmers of Illinois for the express purpose of studying the economics and management of livestock production. In Illinois, as in Minnesota, records were obtained by a route man who visited the farms of co-operators frequently, to assist in accumulating the data and supervising the records. The number of farms from which records were obtained varied from ten or twelve in each area in the early stages

[1] *Bulletin 97*, Minnesota Agricultural Experiment Station, 1906, and *Bulletin 48*, Bureau of Statistics, U. S. Department of Agriculture, 1906.

of the study, to thirty or more in later years when the farmers had become familiar with the form of the records and when transportation facilities were more rapid than in the early days.

THE SURVEY METHOD OF RESEARCH INTRODUCED. Another innovation in farm management research was introduced by Warren of Cornell University. As a graduate student at Cornell he had, through the instruction of Roberts, Hunt, and L. H. Bailey, gained his original inspiration for research and teaching in the farm management field. The first attempt to use the method is described as "An Apple Orchard Survey of Wayne County."[1] This study convinced Warren, as Hays and Boss had been convinced, that to make a satisfactory analysis of the income from farming it would be necessary to have records from the whole farm as an operating unit. He therefore revised his plan of attack, and, in 1906, undertook to apply the survey method to making an analysis of the management and business operations of a large group of farms. The results of this survey were not satisfactory, but records were again taken in 1907 and, when again repeated in 1908, were perfected, and the results published in a comprehensive bulletin which was widely used as a guide for similar studies in many states.[2]

The Office of Farm Management, United States Department of Agriculture, was informally established in the Bureau of Plant Industry in 1902, with Spillman, Agrostologist of the Bureau, in charge. After some unfruitful attempts at describing successful farms and in organizing demonstration farms, he turned to other methods of studying farm management. In 1909, the Office of Farm Management began using the survey method of research in co-operation with Cornell University and several other states. E. H. Thompson, trained by Warren at Cornell, had joined Spillman's staff and actively led the research. The enthusiasm of Spillman coupled with Thompson's industry and persistence, did much to popularize the research and to spread its influence throughout the state experiment stations and colleges. Particular emphasis was laid upon finding the "factors affecting profits" from the farm business unit.

The survey method of research developed at Cornell has since been widely used, not only in the United States, but in Canada, Great Britain, and Germany, in times of crisis in agricultural production, and like the cost accounting method developed at

[1] *Bulletin 226*, Cornell University Agricultural Experiment Station, 1905.
[2] *Bulletin 295*, Cornell University Agricultural Experiment Station, 1911.

Minnesota, has added much to the fund of knowledge about profitable farming.

VARIATIONS IN METHODS OF RESEARCH. While the detailed cost accounting method and the farm management survey method of research have contributed most toward the goal of scientific management of farms, there have been variations from both methods which have yielded significant results. These have taken the form of *Farm Practice Studies* and *Enterprise Efficiency Studies*. Some of these studies have been made by the survey method and some by the farm cost accounting method. The enterprise study approach has been effectively used by R. L. Adams in California, by Peck in Minnesota, by the Bureau of Agricultural Economics, by H. C. M. Case and M. L. Mosher in Illinois, and by others, often in co-operation with the Bureau of Agricultural Economics, Washington.

FARM MANAGEMENT SERVICES. Following the initiation of the cost accounting studies in Illinois by Handschin in 1912, a comparative study was made by Handschin and Case in 1915 of the survey and the cost accounting methods of obtaining farm records. The conclusion was reached that under Corn Belt conditions greater accuracy was obtained by the use of the Account Book Record kept by the farmer and that the difference in cost was not significant. The results of the analyses of these cost accounting records proved so valuable in assisting Illinois farmers to improve their farm operations, that the Extension Service of that state set up a state-wide project in farm cost accounting.

Appreciation by farmers of this type of assistance was shown by their willingness to contribute financially to the project in order that fieldmen could be employed who could give full time to servicing limited groups of farms. In 1924, a Farm Bureau Farm Management Service was organized in Illinois which has since been widely expanded. Mosher reports [1] that since 1937 it has spread into 37 counties covering the north third of the state, and that in 1945 there will be about 1,900 co-operators in 54 counties served by 9 fieldmen. The yearly records secured from these co-operators serve as the basis for a state summary, giving averages of data by counties and type-of-farming areas. From such data an annual summary is published which serves as a basis for formulating a program for the years ahead. The success of this type of research in Illinois has prompted similar work in a number of

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[1] *Journal of Farm Economics*, Vol. XXVII, No. 1, p. 28.

other states and is resulting in the accumulation of a large amount of valid data useful alike to farmers and educational institutions.

The *Budget Method of Analysis* as developed by G. A. Pond of Minnesota and J. W. Tapp of the Bureau of Agricultural Economics, Washington, and published in 1923[1] has also been widely used. It has proved useful as yielding source material for instruction and in advising individual farmers how to improve the income from farming. The use of the budget method is illustrated in Chapters VIII and XVI.

Developments in Farm Management Instruction. As previously noted, courses in which farm management received some attention were taught as early as 1895. It was not until the findings of the *Cost Accounting Studies* in Minnesota and of the *Farm Surveys* in New York were published that satisfactory subject matter for sound instruction became available. Hunt's book entitled *How to Choose a Farm,* published in 1906, and Hays' book, *Farm Development,* 1910, illustrate the nature of the subject matter taught as farm management at the time.

To Fred W. Card of the Rhode Island College of Agriculture belongs the credit of publishing the first book on Farm Management in the United States. It bears the publication date of 1907. This book contains a discussion of the fundamental principles and problems of farm management but unfortunately there was little research data available at that time to illustrate these principles or offer a solution to the problems involved.

Warren of Cornell followed in 1913 with his text bearing the same title. In the preface to this book Warren says, "The best way to find out what methods of farm organization and management are most successful is to study the methods now used and the profits secured on large numbers of farms, and determine how the more successful ones differ from the less successful, and find to which of the differences the success is due. After such principles are found, they need to be tested by use in reorganizing farms." The content of the book is based upon data gained from the farm management surveys made in 1907-1908 and subsequent years, and used in lectures to classes in farm management. It had been preceded by a small book, *Laboratory Exercises in Farm Management* by G. F. Warren and K. C. Livermore, published in 1910, and made up largely of examples and estimates drawn from the surveys then under way.

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[1] *Bulletin 205,* Minnesota Agricultural Experiment Station.

Boss of Minnesota published a book in 1914, also under the title of *Farm Management.* This book was based on a course of lectures given in the classes of the Secondary School of Agriculture and, with some expansion, as an introductory course in the College of Agriculture. The subject matter of the book was based largely on the findings from the cost accounting researches, and from the experiences gained in guiding students in farm planning activities in earlier years. While not primarily written as a college text, it was quite widely used for a number of years as such in introductory courses.

These books served the colleges and schools as the only available texts on farm management for nearly a decade before new treatises appeared. Meanwhile research had been continuing and expanding widely, bringing into available form new source material and factual support for service to farmers and college classes. Bulletins giving the results of researches were freely published by the United States Department of Agriculture and by state experiment stations, thus bringing into use many new approaches to the solution of problems met in the successful management of farms. These bulletins also yielded much new matter useful to the writers of textbooks, a number of which have appeared since 1920. A list of such texts will be of interest as showing the advances made. The list follows:

1921 *Farm Management,* R. L. Adams.
1923 *Farm Management,* W. J. Spillman.
1924 *Farm Economics, Management and Distribution,* Frank App.
1924 *The Farmer and His Farm,* Frank App and Carl J. Woodward.
1925 *The Management of the Farm,* L. A. Moorhouse.
1928 *Economics of Farm Organization and Management,* C. L. Holmes.
1936 *Elements of Farm Management,* John A. Hopkins.
1936 *Profitable Farm Management for the Corn Growing States,* L. S. Robertson and M. H. Overton.
1938 *Farm Organization and Management,* G. W. Forster.
1939 *Farm Management,* Robert T. Hudelson.
1942 *Farm Management and Marketing,* V. B. Hart, M. C. Bond and L. C. Cunningham.
1946 *Managing a Farm,* Sherman E. Johnson, Neil W. Johnson, Orlin J. Scoville, Martin R. Cooper, and Samuel W. Mendum.

1946 *Farm Business Management,* H. R. Hare.
1947 *Farm Management,* John D. Black, Marion Clauson, Charles R. Sayre, and Walter W. Wilcox.
1948 *The Business of Farming,* Herrell DeGraff and Ladd Haystead.
1948 *Starting and Managing a Farm,* C. M. Hampson.
1948 *Efficient Farm Management,* Paul W. Chapman, W. Gordon Leith, Frank P. King, and L. S. Hardin.
1950 *How to Make Your Farm Pay,* Carl C. Malone.

It is not possible to name here all who have contributed to the development of good farm management procedures and to building up a substantial body of subject matter for use in the scientific management of farms. The discussion offered has emphasized the specific contributions of the pioneers who did the spade work in laying the foundation for research in this intricate and complex field. From that foundation, significant advances have been made in establishing the facts and principles governing continuously profitable farming. There is still much to learn in the field of farm management. The need for initiative and vision is greater now than at the beginning of the century. Will new pioneers arise to carry forward the work so well begun? Only time can tell. The world is calling for vision.

Chapter III

CHARACTERISTICS OF FARMING

What is farming like? Is the farm a good place to live? Is farm work hard and unpleasant? Will there be good schools in the country? What social institutions will be found in the country? Will a farm yield a good living and competence? Who should farm? Is farming a permanent industry? These, and many other questions, will be asked by young men and young women who are looking into the future in search for a satisfactory life-work. While it is not possible to answer these questions directly and specifically, discussion of farming and farm life will bring into view some of the most important characteristic features of the vocation. Knowledge of these will be helpful in reaching a decision as to whether or not one should undertake the occupation of farming.

The Nature of Farming. Farming is a wealth-creating process. The farmer in America lives upon a piece of land over which he has at least temporary control. Control may be gained by ownership or by a lease contract for a short or a long period of years. The farmer prepares the soil and plants the seed. The seed springs into life through the laws of nature and crop plants are produced. Not only is the seed reproduced, but it is increased. In some crops it is increased "tenfold, in others an hundredfold." With some crops the return comes quickly; with others, such as the tree fruits and some of the larger animals, it may take a period of from five to ten years before material returns are made. This period of waiting must be endured before the full farm plan can be developed. When it is developed, however, a sound farming plan has been completed. Wealth is created in the form of crops that did not previously exist. This process is repeated year after year. Nature is the chief contributor in this wealth-creating process, but the farmer assists Nature to do her best. It is because of this assistance by the farmer that domesticated plants give greater increase than native plants growing on untilled land without such assistance. In the same way the farmer gathers together a flock of poultry or of sheep or a herd of swine or cattle or some other class of livestock. He provides feed and shelter for them and sees

that they are mated for reproduction. Young animals are born under the natural laws governing animal life. Some mother animals yield an increase of only one offspring annually, others may yield several. Whether they yield one or many, life that did not exist before has been generated. New wealth has been created. Nature and the farmer in partnership have created it. Farming, therefore, is, in the first place, a working partnership with nature in the creation of new wealth. Those who make the greatest success of farming are those who love nature, and who choose to match their wits and knowledge with nature in bringing forth from the earth the fullest possible increase. That opportunity and purpose should result in bringing to the farmer a good income, which is the first essential of satisfactory living in this modern world. The farm is, secondly, therefore, a place of business.

It is customary for farm families to live upon the farms which they operate. The farm must, therefore, be a home as well as a place of business. It can not be regarded as a successful farm unless it affords a comfortable home, good housing, a cheerful outlook, and a desirable environment for the family. Because the home and the place of business are so closely associated, one sometimes suffers neglect for the benefit of the other. It is not uncommon to find a good farm business conducted at the expense of the home. The profits made on the farm business are sometimes used to buy more land or to build bigger barns to increase the size of the business, when the best interests of the family call for improvements in the home. On the other hand, houses and barns are not productive enterprises. The income from the farm comes from the fields and the flocks. The capital resources and labor spent upon buildings and upkeep seldom return much on the investment. Expended on the fields and productive livestock enterprises, they add to the wealth of the farm.

Few farm families go hungry, as they are at the source of food supplies. Many go short of clothing, education, recreation, and medical care, however, because of the ever-present urge for building up and expanding the farm unit. It requires much thought, family co-operation, and good management to maintain a proper balance between the business and the home aspects of a farm, and provide opportunity for the development of a well-rounded family life.

The Farm as a Place to Live and Work. There is much to be said for the farm as a place to live and work. The wholesome food, the outdoor life, and the early assignment of children to

light chore work and eventually to a full share of work and responsibility of the farm tend to develop physical capacity, self-confidence, and mental independence. These are useful attributes, not only in farming, but in other vocations which may later be entered. A high class of citizenship has been produced on American farms. Most of the leaders in civic or business affairs of the United States have come from farm families. Few children grow up on farms without learning to work. Ability to work is a distinct asset in any vocation. Not all farm-reared children like farm work and many seek work in other fields of usefulness, but that fact does not lessen the value of the farms as training grounds for young people.

The farm family has many advantages in child training. Children are able to do light work by the time they are five years old. It is well, then, that they have some regular work to do as a matter of discipline. The tasks of carrying firewood, gathering the eggs, and helping to keep things in order are an easy beginning. These are tasks that the city home can not readily provide. As a consequence, city boys are often in idleness or in mischief, when farm boys are learning to work. On the farm the boy soon begins to accompany his father about the barns and over the fields. This companionship is good for both the boy and the father. The boy helps the father with the work and feels that he plays an important part in it. As he grows older, he learns how to do many things. He may take the responsibility for the care of part of the livestock, and eventually of all. He soon learns that he must not neglect his stock even if he is tired or desires to play. He learns the value of time and to make the best use of it. He learns that, if he is to be a useful member of the farm crew, he must work even when he would rather not. He has manual training in many lines. He takes responsibility and has the companionship of his father in most of these enterprises. He learns many things that can not be learned in school. Boys who grow up on the farm are on the whole much better prepared for the world's work than boys who have never done anything but go to school and play on the streets. While the farm boy is being trained by the work he does, he is at the same time contributing to the success of the farm. Moderate work develops the muscles and the mental discipline is good for the mind. There is little danger that boys may be overworked, though it is possible. There is not so much danger to farm boys from overwork as there is to other boys from underwork.

Girls, likewise, begin to work at an early age on the farm. It is true that they may also have duties in city homes, which will occupy their attention. The training on the farm is broader, however, than can be given in the city, because girls are often called upon to do outside chores and soon learn to care for the garden, poultry, and even to participate in some of the other light work of the farm. The whole family is more completely employed on the farm with the farm and home affairs than they can possibly be in the city. The experience gained and the responsibilities carried by all members of the family are good preparation for the work of after years, no matter what it may be. Farm life has in the past been more isolated and for that reason less spectacular than life in the city. Improved facilities for transportation, for communication, and for entertainment in the country have removed much of this isolation. Better country schools are now being provided and most farm children live within easy reach of good schools and educational opportunities. The family that desires to do so and is competent in managing the farm business can now live as well and enjoy the same comforts of life in the country as are enjoyed by those having the same financial status in the city.

It is probable that family life is better preserved in the country than in the city. Because all are employed on the farm or in the farmhouse, the members of the family have a common interest in the farm as a whole and in one another. There are also fewer distractions to break up the family circle and to take attention away from the work and the affairs of the home.

Much of farm work is hard and sometimes dirty and disagreeable, but work in the city also is often very distasteful. The "dirt" with which the farmer deals is for the most part clean and will wash off. The "dirt" and "smut" of the city can not be removed so easily.

Because the farmer deals with plant and animal life, which are biological processes, constant care and attention are required. Farmers work more hours per day than those in city employment. The speed of work on many operations, however, is not so fast nor so continuous as is required on many industrial jobs. The time taken for getting to and from work is much less on the farms than on industrial jobs. Some of the work must be done early and it is impossible to avoid emergency work at any hour of the day or night.

The farmer's work is more seasonal than that of most city jobs.

The planting and harvesting seasons are the busiest and call for longer days. There is much work, however, in tilling the crops when the pressure is not so great. There is also work to be done in caring for the animals. More time is required for this work in the winter season, when the animals in most climates must be housed. On the well-organized farm there is little spare time and but few vacations. But, by co-operation between the members of the farm family or between the family and the hired help, it is quite as possible to find play spells and take vacations as in any other vocation.

The nature of the work farmers have to do requires rough clothes and stout shoes. It does not follow that farmers shall be otherwise poorly dressed. The rough clothing is quite as appropriate to the farmer on his farm as the fine clothes of the banker or businessman are to his work in town. Most farmers provide themselves with dress clothes when needed.

The food of farm families, coming, as much of it comes, direct from the garden, fields, or barns, is more likely to contain the required elements of nutrition than the purchased food of the workingman's family in the city. The food used by city people is likely to be composed of cereals, with less of meat, eggs, milk, fruits, and vegetables and is, therefore, not so well provided with vitamins as the food consumed by the farm family.

As a result of outdoor life and good food, farmers and their families enjoy a longer period of life than city people. Were all farm homes properly equipped with sanitary facilities, and were farm families as well provided with medical and dental care as are available to city people, there is no question that the health advantages would be strongly in favor of the country.

Income from Farming. Income from farming is not measured entirely in terms of cash. It is difficult, therefore, to state in exact terms what the income may or should be. It often varies widely from year to year because of climatic influences on crops, or because of wide fluctuations in prices for farm products. Part of the income is derived from farm products sold for cash. Part of it is in the form of farm products used by the farm family for food, thus avoiding the outlay of cash. The farm also provides shelter for the family, and many farms produce a part of or all of the fuel needed. These products also save a cash outlay.

There is no very satisfactory way of summarizing all these items in a form that permits a direct comparison of farm incomes with the incomes in other lines of industry. Numerous items must

be considered in estimating the income from farming. If the farm is owned and without debt, the invested capital is a factor in earning income. The amount of capital invested in the farm would, at the present time, earn 2 to 2½ per cent interest if invested in government bonds. It would earn 1 to 2 per cent if deposited in a savings account with a well-financed bank or loan association. A good farmer would expect to earn fully as much on money when invested in a farm. To illustrate this point, it is assumed that one has accumulated from some source a fund of $5,000. Invested in a 2½ per cent government bond it would earn $125 annually. If the sum were invested in a farm, it would be expected to earn at least the same amount in the form of produce raised for sale or for use by the family. If the sum of $5,000 were borrowed from the Federal Land Bank or similar loaning agency for the purchase of a farm, an interest charge of 4 per cent would have to be made for the use of the money. Invested in a farm at that rate, $200 of the farm income should be credited to earnings on the investment.

Much of the farm work is done by members of the farmer's family who are not paid a direct cash wage. Many of the farm boys and girls could and do earn a direct cash wage by working for neighboring farmers when they can be spared from the home farm. Obviously their work contributes at the same rate, to the income of the home farm when they are engaged there on productive work. The labor of the farmer is paid for in the crop and livestock products he raises for sale and for use by himself and family. It will be seen, therefore, that there is no direct wage or salary for the farmer to compare with the wage or salaries of those employed in the industries. The farmer is more nearly on the basis of the small businessman or storekeeper, who makes for his salary whatever he can by economically running his own business and operating with his own labor.

One measure of the returns from farming is the net farm income. This is determined by subtracting the total expense for operating the farm from the total farm receipts. The result is the total net farm income or the amount that has been earned by the family and the investment together. To this must be added the value of the food supplied by the farm, which has a cash value, and the value of the house as a home for the family. If fuel has been provided from the farm the value of that should also be counted.

The following example of a net farm income will help one

to understand how the earnings of the farm business are distributed over the various branches contributing to the earning power of the farm. It should be noted that this is a hypothetical example set up to show the method rather than to show the exact earning power of the farm:

Gross Income	$4,800.00	
Operating Expense	3,300.00	
Net Farm Income from Cash Sales		$1,500.00
Of this—Earned by investment	600.00	
Unpaid family labor	300.00	
Value, operator's labor	600.00	
	$1,500.00	
To this should be added:		
House rent—$2,000 house at $12.50 mo.		150.00
Food supplied by farm—estimated at		200.00
Fuel produced on farm—estimated at		50.00
Total		$1,900.00

Annual incomes from farming are rarely large. Experienced and skilled farmers on good farms may by superior management and thrift earn large incomes in favorable years. In other years the incomes may be small. On the whole, people living on farms accumulate more wealth than those living in cities and towns and working on salaries. The wealth accumulates slowly year by year by increasing inventories in livestock and products, by improvement of the soil, by the addition of buildings or equipment, by making payment for land or other indebtedness, and by improving the physical organization and appearance of the farm. While this process is going on it may not yield ready cash for living expenses, but it does add to the value of the property. In the course of an average lifetime, a thrifty farm family will have accumulated a good farm and, in many cases, a sufficient competence to permit the operator and his wife to retire from active management if they wish to do so. The necessity of waiting for crops and animals to mature and the absence of a monthly pay check are factors that contribute to the "saving urge" which is vital to the accumulation of wealth. Those on monthly salary are much more inclined to spend as they go and look to the future for savings.

Farming is a conservative business which changes but slowly. Farmers live close to nature where food supplies are produced; they have, therefore, first access to them and rarely go hungry. In the desire to accumulate more land or more property they

sometimes deny themselves and their families educational privileges, vacations and entertainment which town families regard as a part of everyday life. With the advent of good roads, the automobile, the radio, and other modern conveniences, there is a tendency away from such denial and many farm families may now enjoy not only these privileges, but the advantages of electric lights, running water, and the other home conveniences that most town families may have.

Farming a Permanent Industry. America, up to the present time, has been a land of self-determination for people. Lines of human endeavor have been open to free competition and each individual has had the privilege of choosing a vocation and a mode of living. Under such circumstances, people have flocked quickly into any vocation which at the time seemed to hold special advantages for easily making a living or for accumulating wealth rapidly. They have just as quickly left a vocation which became unattractive or unprofitable. In this way balance has been maintained in general between the vocations, so that those in one line of endeavor or occupation have not for long had distinct advantages over those in other occupations.

Food, clothing, and shelter, the primary needs of mankind, come from the land. From the days when primitive man roamed the plains and the forests appropriating to his own use such cereals, fruits, and meats as nature provided, to the present day, when a highly organized agricultural industry assists nature to provide these primary necessities, people have lived upon the land and devoted their energies to tilling the soil that all may have food. So long as the earth is populated, these primary needs must be supplied. Farms are the basis of food supplies and of the raw materials for many industrial uses. For these reasons agriculture is said to be a great basic industry and one of the most important so far as national wealth and welfare are concerned. Farmers will always be needed. Farming is, therefore, a permanent industry.

Location Important. There are many things to consider in starting a farm business. One should keep in mind that it takes time to become well established on a farm, that much equipment must be provided, that buildings must be planned and erected for the purposes they are to serve, and that a considerable investment of capital must eventually be made. It is serious to locate in the wrong place for the type of farming to be done or in an unprogressive community or neighborhood where living condi-

tions are undesirable. Forethought and investigation will make it possible to avoid these mistakes. Planning the business before starting or at least making tentative plans will avoid expensive mistakes that may interrupt or discourage the whole business venture. Information should be sought from all available sources about location, type of farming best to undertake, and the plans for operating that will be most effective and satisfactory. Those who have been reared on farms will know better than others about certain types of farms with which they are familiar, but they, too, may easily make mistakes when thrown on their own judgment. Even mature men and women who are familiar with the farm environment and duties may make mistakes, if they depend on their own judgment. Those reared in villages and cities have little knowledge about any kind of farming or how to start and manage. It is advisable, therefore, to study carefully in a systematic way the most important considerations involved in the acquisition of land and the organization of a farm business which will be at the same time a satisfactory farm home. Attention will now be invited to some of these important matters.

Since, in nearly all cases, the farmer and the farm family live on the farm operated, the question really will be, where do I wish to live? Shall it be in sunny southern California, where mild temperatures prevail throughout the year, where irrigation must be depended upon at least to a large extent, and where fruits, vegetables, barley, and hay are among the chief crops grown? Shall it be in Florida, with its abundance of citrus fruits and vegetables, with a milder winter climate than California, but with a hotter summer; or shall it be in the New England states, where winters are long and cold with temperate summer months, where snows are deep, grass is plentiful, and sparkling pure water abounds; or shall it be some place between these two extremes? There is the Cotton Belt or the Corn and Wheat Belt or the Corn Belt in between from which to choose. Others may wish to spend a life on the Great Plains, where wheat-growing and ranching receive chief attention. These and many other locations demand serious consideration from the person or persons contemplating a life on the farm.

In making a choice as to where to farm, one should get the most reliable information available about the particular locality in mind. The amount of precipitation in rain and snowfall over a period of years should be studied. Distribution of rainfall over the crop-growing period is an important matter. The frequency

of hail storms, cyclones, and floods or drouths should receive attention. Some localities are much more subject to these disasters than others. Temperature ranges, both winter and summer and through the growing season, determine the kind of crops that can be safely undertaken. The number of days of sunshine and night temperature also are factors in aiding or retarding plant growth. They also affect the health of the family. The United States Weather Bureau records for the region will give much information on these points if studied carefully. The record for a period of at least ten years backward should be carefully analyzed. A longer term would be still better. The Bureau of Soils of the United States Department of Agriculture can furnish soil maps for many areas that indicate the kind and quality of soil. Soil is an important consideration in setting up any farm business. The various state departments of agriculture and the agricultural colleges throughout the agricultural extension service and the county agent can give most valuable help in learning the characteristics of any region. If at all possible, the region should be visited and note made of the general prosperity as indicated by the farmsteads and other external appearances of the countryside. One must keep in mind that the income from farming comes from the land. It is from the income that farmsteads are built. A region with unfavorable climatic conditions and poor soil will not permit good buildings or provide a satisfactory income and living for the farm family. Vegetation in the form of native grasses, trees, and even weeds, tells the story of the productiveness of the land. Neither large trees nor large weeds grow on poor land.

The condition of the roads indicates the unconcern or progressiveness of the community. School buildings and churches reflect the community life, interests, and activities. Co-operative institutions, such as creameries, oil stations, stores, elevators, and the like show a co-operative spirit. The healthfulness of the region, the class, and even the nationality of the people should be considered. When all possible information has been obtained about these phases of the subject, as well as other points that may be important, one is better able and ready to decide where to locate.

Farming a Nature Lover's Job. For those who have had limited opportunity to become acquainted with agricultural operations, it may be helpful to outline some of the advantages and disadvantages of farm life. Most persons inherit a per-

sistent love of nature. Those who live in the city enjoy feeding the birds in the park, growing flowers in window boxes or arranging unusual effects through landscaping. Even in crowded tenements this urge to make something grow is not unknown, though its only outlet may be a few geraniums in tin cans. The farm offers full opportunity to satisfy this natural instinct. Nature is an intricate, fascinating, and mysterious mechanism which constantly rearranges chemical elements by breaking down, through decay, old forms which are no longer useful and building new plants or animals in endless succession. It is the farmer's function to understand and take advantage of these processes in such fashion that human needs may be met for food, clothing, and shelter. Finding ways of satisfying our wants from nature's resources is an age-old task, but always new.

For one who loves this work there is constantly recurring interest and pleasure in ordinary farm operations. Starting for the field in the morning, when the air is sweet, the grass shining with dew, the bird chorus at full volume, is an experience one never forgets. It is good to feel strength in healthy muscles, able and ready for the day's task. It is intensely satisfying to drive a powerful, well-matched team or a tireless tractor responsive to a touch of the finger, while preparing the fertile soil just longing for the seed, or to harvest a fat crop, the reward of nature's abundance and man's well-directed effort.

There is sentiment, comedy, pathos, and tragedy in associating with livestock. There is the miracle and suffering of birth with the wholesome excitement of helping a new arrival to its feet and gently introducing it to the "fountain of youth" proudly offered by its anxious mother. There is the comradeship of trusting animals whose well-being is dependent upon the skill, labor, and sympathy of their caretaker. There is the welcome when the barn door is opened each morning and every friendly animal calls a greeting. There is stimulation in watching hungry animals convert quantities of rich feed into meat, milk, or power. And there is a heartening financial reward in sight when the job is well done. Farm life offers many attractions.

FARMING HEALTHFUL. (Farming is a healthful occupation.) Modern farm homes can have every city convenience. Hard work in the open air enables one to enjoy an abundance of good food, largely home grown, and an easy chair when the labor of the day is ended. It is an ideal place for children, because they have ample room for play and daily duties which teach thrift,

order, and responsibility as companions and partners with their parents.

The home is the business office of the farm. Here plans are made for organizing the daily operations, so that the home may prosper. Every member of the family can be a director in the firm, with a definite part in making the income adequate for the attainment of individual needs and family ambitions. Children learn the rewards of hard work. The facts of life are commonplace and well understood. Companionship with animals is clean, wholesome, and instructive.

The farm family is a unit representing management, labor, and capital. Every member has a job worth doing, with the returns limited only by ability, application, and the chances of nature. Those who are capable of enjoying hard work, close family life, and intimate association with living, growing things in God's great out of doors, will be able to find much satisfaction in life on the farm as mutual interests develop.

Farm Life Has Responsibilities. Every profession, occupation, or way of life has an appeal which makes it attractive and also disadvantages which are inevitable. In choosing a path to follow, young men or young women will do well to weigh carefully their personal likes and dislikes in order to select a field of work which will bring the maximum satisfaction of their individual tastes, wants, and desires. The only way any profession can become a "bed of roses" is to find so much enthusiasm and inspiration in the pleasant and enjoyable things that the unpleasant parts shall become relatively insignificant.

Farming has features which make it pure drudgery for some persons. Take, for example, hard physical work, of which there is never a lack where livestock and crops are being grown. Mental labor is needed for planning and estimating and for developing sagacity and judgment in the conduct of a farm business. A young man may prefer headwork or handwork, but a farmer must do both. Boys like to play football and glory in their bumps, their strength, their strategy, and their success. Life can be a game or a prison sentence, depending on one's attitude and reactions.

The growing of crops and livestock requires hard work, both physical and mental. With the animals especially, it necessitates constant care and attention. Cows have to be milked and hogs fed, even when the circus comes to town or the local Farm Bureau is holding a picnic. On a one-man farm the operator is literally tied to his milk stool—or milking machine in this modern age—

and he must care for his stock at least twice a day regardless of allurements elsewhere. Of course, he will soon plan to enlarge his operations, so that two workers shall be available, to change about when time off is needed; but the farm manager is never free from responsibility for all the animals, equipment, and operations under his direction.

Farm Duties Variable. The farmer must be somewhat of an engineer in laying out his farm buildings, arranging his fields, deciding what machinery is necessary, and balancing his program, so as to bring about the best results. He must do the work of a mechanic in repairing machinery, maintaining plumbing and electric lines, overhauling tractors, mending harness, or patching and remodeling buildings. It takes too much money to hire all these things done.

The farmer must be an agronomist to make the best use of his land, decide what crops to grow and where to grow them, keep informed on new varieties that are being produced and the latest methods of combatting weeds, insects, and diseases which will keep his useful plants from attaining full production.

A good livestock man must understand the principles of animal breeding and the manner in which characters are inherited. He must be able to judge animals as to their good qualities and defects. He must nurse them when sick, understand vitamins and diets, know the composition of feeds and their effect in various combinations, recognize common diseases and symptoms, learn how to avoid or treat contagious diseases, so as to keep his stock healthy and contented.

The farm manager is responsible for every weed, every plant, every machine, every animal, every post, and every piece of wire on the farm. Each one of these can make trouble or contribute to the well-being of the whole enterprise. A farm that is well run works smoothly most of the time and "good luck" prevails; but, let the farm manager neglect his job, even for a little while, let him "put off" something he doesn't like to do, let him get so mired in details that he fails to see all parts of the picture, and the farm will run him. It will run him ragged.

The Farmer a Businessman. Engineer, mechanic, agronomist, animal husbandman, the farmer is also the business manager of his enterprise. He can lose his profits by poor trading or lose his farm by unwise financing. He needs to know something of business, legal procedures which relate to the farm, economics, bookkeeping, and enough banking to use credit with-

out abusing it. It is obvious that all our present farmers have not had special training in these phases of the whole farm problem, but the successful men have learned something about them, often through hard and costly experience.

Lessons may be learned by training or trying. Difficulties, troubles, mistakes, and losses may be avoided by learning from others; so the more complete the information possessed by the farm manager, the more smoothly his work is likely to progress. There will always be plenty of projects to try, plenty of new experiences, and plenty of things will go wrong, but sound training will help to solve problems as they arise. Headwork will often replace considerable handwork, especially as the enterprise grows and the operator gets older, wiser, and more competent.

Besides his care for every part of the farm organization and operation, the farmer is responsible for the habits, character, and welfare of those depending on him. It is his duty to see that labor and recreation are so distributed that both serve their best purposes. He is obligated to provide the best housing and the most comfortable and healthful surroundings for his family which his ingenuity and financial condition will permit. Money and labor are both necessary on the farm; but, if they prevent the development of a pleasant and happy family life, the organization becomes unbalanced and can not achieve the greatest success as measured in human values.

A good farmer must also assume responsibility toward his neighbors, his community, his state, and his country. Certainly, a part of his skill, knowledge, and effort should be used for public improvement. He must then take an active interest in school, church, co-operative enterprises, township affairs, and politics in the broadest sense of the word. American institutions do not run themselves. They depend on the understanding and the directed effort of individual citizens, continuously applied to local as well as state and national conditions. A good farmer is a helpful member of the community. What is good for all is good for him, and unity of action brings achievement.

The Rewards of Farming. The young man who asks "Do I want to farm?" naturally thinks first of the immediate advantages and disadvantages of farming as a steady, day-to-day job. Next, he will want to look further ahead. "Where shall I be twenty years from now?" There will follow another series of questions which may apply to any profession, and, again, personal ideals, ambitions, talents, and preferences must be considered in

the answers. "What is the goal of achievement?" If it is to make much money quickly, farming is not likely to be the life which he should seek. That aim is more likely to lead to large cities and big business. If his hope is for security, peace, contentment, a pleasant home, and reasonable independence, a farm offers plenty of opportunity, if he is capable and willing to earn advancement by his own efforts. Few paupers are found on farms.

(The only way to accumulate property is by saving.) Men on a salary know exactly what their income will be and usually set their standard of living accordingly. They have little incentive for saving, because there is no immediate place to put aside money except in a bank or in life insurance. It takes imagination to see more value in cold black figures in a little book than in a hundred comforts or pleasures which may be enjoyed immediately.

On the farm it is only natural to accumulate property. At the end of the year there are likely to be more calves, lambs, or pigs than at the beginning. Fences, tile lines, machinery, tools, buildings, water systems, electric service are all wants which may be satisfied by relatively small accumulations of money, but together they add up as increased property. In other words, there is a strong incentive for farmers to buy or keep things of permanent or semipermanent value. At the end of twenty years, if reasonably efficient in financing and fairly successful in his operations, a farmer is much more likely to have a comfortable estate than a man of equal ability who lives in the city.

Few farmers become wealthy as measured by city standards, but the proportion of farmers who earn a comfortable living is undoubtedly higher than the average in the city. Unusual ability can earn an unusual income on the farm, as elsewhere. An annual labor income of $3,000 to $5,000 per year is not uncommon among farmers, particularly those who have developed some specialty. A great many farmers accumulate estates of $50,000 and up. Aptitude, training, ability, and energy are important factors in earning satisfactory farm incomes.

Part of the farmer's pay is in satisfaction. It is a personal business, in that the manager plans and executes the whole range of production from calf to fat steer, from seeding to harvest, from hay to butterfat. It is sometimes disagreeable to get up in the middle of the night and wade out through snow, mud, and slush to see that a farrowing sow is progressing favorably and saving her pigs, or to help a cow welcome her offspring; but

the disagreeableness disappears, however, as one lifts a gangling baby calf to its feet and assists it to find the usual source of warm milk, and visions a high-producing cow, a valuable bull, a prize winner at the fair, or part of a new car purchased with the income this arrival will bring when well raised.

There are few business enterprises which permit an individual to exercise such complete control over all the factors of production as one does in farming. The quality of product is largely due to his own skill and effort. A fine bunch of hogs, a yard of fat cattle, a high-producing herd of cows bring satisfaction and contentment with a task well done. There is always a goal toward which to strive, something new to try, freedom of action, responsibility of the highest order, and, as a reward, a comfortable home, an adequate income, substantial savings, and as much independence as anyone can have except on a desert island. There is much satisfaction in successful farming.

All these inducements help to insure stability. The farmer settles down to a life job, usually on one piece of land. He hopes to manage that land in such a way that it will remain rich and productive. He plans to put up a fine set of buildings as he earns the money for them. This is his home, his life work, most of his recreation, and his estate. As he advances in age, his property should increase, his debts should be paid, his sons or younger men should take over the harder physical labor, leaving the manager more free for community work, travel, and outside activity, yet retaining control because of his experience, skill, and managerial ability.

✓Chapter IV

NATURAL RESOURCES IN RELATION TO FARMING

Agriculture is one of the basic industries of America, since it is the source of supply for food and clothing, which are the primary needs of mankind. Its foundations are laid in the great natural resources which constitute the basic wealth of the nation. To understand the agricultural industry and the art of farming, knowledge of these resources, their relationships, and importance is required. Therefore, a brief discussion of these factors follows.

NATURAL RESOURCES

Natural resources are the great storehouses of Nature's own products which may be used for human benefit. Some of these, such as air and sunshine, are so abundant as to be practically unlimited in quantity and are inexhaustible. For these there need be no concern. Others, of which land, forests, and minerals are examples, are so limited as to be unequal to present or possible future needs. Past generations have lived upon these resources, and individuals have built up great fortunes by converting the easily available materials into other forms of personal wealth. In many instances the conversion has been accompanied by great waste. The present generation, if it is to enjoy a good living standard, must gain its livelihood and wealth from the utilization of these resources. They should be used to the best advantage, however, and without unnecessary waste and exhaustion. The present generation should use, protect, and improve them wherever possible in consideration of the welfare of future generations.

These natural resources, while at times remote from one another, are often interlocked. Forests grow upon land that is needed for food or feed crops. They must be cleared to provide farm land. Crop land must sometimes be sacrificed so that mineral resources, such as coal, iron, or oil, may be extracted from it. Under present stages of civilization these resources are complementary in use. That is, they must be combined to contribute full returns to the enterprise. For instance, mineral fertilizers taken from the earth's crust and applied in proper quantities to crop land where needed give largely increased crops.

Pressure for land, as yet, has been but little felt in the United States. It has been heavily felt, however, in the British Isles, in Continental Europe, and in the Eastern Hemisphere, where civilization is older and populations much more dense. Many immigrants have come from those countries to gain possession of free land in America. But even in America land is limited and can not be increased or reproduced. It can be and is being exhausted or at least reduced in fertility. Crop production and erosion have taken heavy toll in some regions and with no restitution. To offset the extraction of the soil elements consumed in crop production and removed with the crops, other natural resources in the form of mineral elements, such as phosphates, potassium, calcium, and others are required. These are usually extracted from the earth's surface or subsurface and applied to the land where most needed to increase its productivity.

Water is necessary to all forms of life. Without it, as will be shown later, there can be no agricultural production. Water in the form of rainfall or snow plays an important part in determining the kind and extent of crop and animal life that may be produced. It differs from other natural resources in that it can be used repeatedly without exhaustion. The water supply of a locality, however, depends upon altitude, topography, temperatures, and air currents. There are, therefore, wide differences in available moisture supplies in the agricultural regions of the United States and, consequently, wide differences in the value of land for agricultural production purposes.

The United States contains greater natural resources and potentialities than most other nations. From the Atlantic to the Pacific and from the Canadian line to the Gulf of Mexico there is a wealth of diversified raw material, a richness and variety of soil, and a climate hardly equaled in any other country. This vast supply of natural resources in our country has been the basis of American wealth and prosperity.

Importance of Land. Land is the first requisite for farming. It is also needed for roads, parks, forests, golf courses, recreation grounds, city buildings, and other social purposes. Land, therefore, is the great primary resource. It is greater than all other resources combined, for it is all-inclusive. From its surface come food, clothing, and materials for shelter. From its subsurface come coal, oil, gas, iron, and many other minerals. Land also contains the elements of plant nutrition. Soil water combines with mineral elements to form the solutions upon which plants

feed and grow. Land can not be produced at will by mankind. It can not be moved about. Man may modify and improve land, but he can not make more, except that some has been reclaimed from lakes and the sea. It must be used where it is, no matter how difficult it may be to till or what circumstances may be involved.

There are no extensive areas of farm land unoccupied in America. It is no longer easily possible to increase agricultural production by bringing new land into use. Those now wanting land from the public domain must be satisfied with a poor quality or unfavorable location. Those wishing to buy land of good quality must purchase it from someone already possessing it who wishes to reduce his holdings or to retire from farming. The productivity of the land determines the density of the population that may be supported upon it. Thus farms in the Great-Plains area are larger and population less dense than in the center of the Corn Belt, in the dairy region, or in the rich truck and fruit regions, where land is of relatively better quality.

LAND AREA AND USE. The land area of the United States is approximately 2,976,563 square miles, or 1,905,000,000 acres. The ratio of land to population is very large as compared with other countries. Only a relatively small part of the land has been brought into crop production and yet nearly two and one-half acres of crop land are harvested per person in the United States, as compared with one acre in Germany, one half acre in China, and one quarter acre in Japan. Agricultural land is used principally for the production of food, fiber, and feed crops, for grazing and pasturing livestock, for the growth of forests, and for fuel and timber supplies. Land is needed also for social and public purposes. The use of land in the United States at the time of the 1945 census is indicated in Figure 1.[1] This chart shows that a little over one half of the land resource is in farms.

Of the land in farms approximately 32 per cent was in crops in 1944; 46 per cent was in pasture, excluding woodland pasture; and 15 per cent, in wood land. The remainder was waste land or land lying idle, and land used for farmsteads and lanes.

While all crop land is in farms, the acreage of pasture, including range land outside of farms, exceeds that in farms. About 65 per cent of the pasture and range land not in farms is publicly owned and 35 per cent privately owned. The present trend is

[1] Reuss, L. A.; Wooten, H. H. & Marschner, F. J. *Inventory of Major Uses of Land in the United States*. U. S. D. A. Misc. Pub. No. 663, page 7.

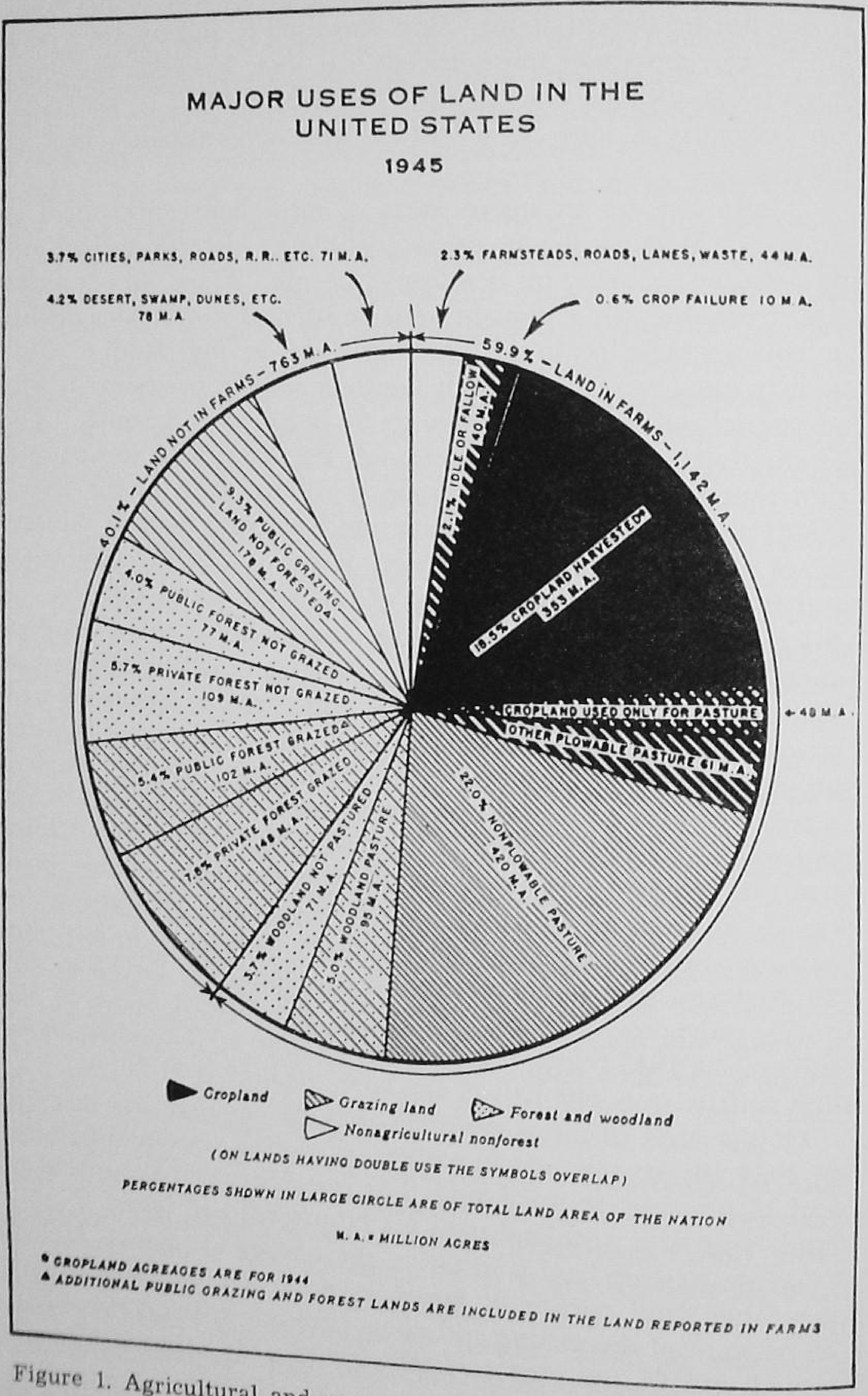


Figure 1. Agricultural and non-agricultural lands in the United States and the uses to which they are put.

toward converting large quantities of privately-owned range land into publicly-owned grass land, as a matter of protection, conservation, and wise use.

Seventy-one million acres of land are used for non-agricultural and non-forest purposes. This land, largely in social use, is of great value because of the concentration of population and wealth connected with its use. About 78,000,000 acres are classified as desert and bare rock, marsh lands and coastal beaches, which have very low valuation so far as production is concerned. They do have a social value, however, or may have when properly used for recreational purposes and the maintenance of wild animals, game birds, and other forms of wild life.

It is surprising to find how little of this vast area is used to produce the food, fiber, and feed crops required to support the human population and domestic animals. Only 353,000,000 acres of crop land were harvested in 1944 and yet they were sufficient to create national surpluses and provide considerable quantities of wheat, cotton, tobacco, and meat products for export. Only four per cent of the total land of the United States, or about 75,000,000 acres, is needed for human food crops. About one third of this quantity, or 25,000,000 acres, is needed for flax, cotton, and other fiber crops, for clothing, and other materials. Thus it is seen that only a little over five per cent of the total land resources is needed at present for food and fiber crops.

To support the domestic animals, feed crops must be produced. The area devoted to this purpose in 1945 was 247,000,000 acres. In addition, 1,052,000,000 acres were used for pasture and range purposes. Of this, only 10 per cent was plowable land in farms. An additional 49 per cent of this pasture was non-plowable or woodland pasture in farms. Of the remaining 41 per cent, two thirds is publicly owned and one third privately owned. Two thirds of all the land used for pasture is classified as grass land and the other one third as forest or woodland.

Land Quality. Land of good quality is an important asset in successful farm operation where the objective is to get the highest possible returns for the least possible expenditure of human labor and capital goods. A unit of man labor or capital goods in the form of machinery, work stock, or seed grain, applied to land of the best quality will yield much higher income than the same unit applied to land of poor quality. It becomes important, therefore, to know what the differences in quality of land are and where the good land may be found. A comprehensive classifica-

tion of the land resources of the United States will be of great value in this connection.

Land classification should be based upon topography and soil quality as determined by careful survey and study. Up to the present time less than one half of the total land area has been covered by soil surveys. It is, therefore, not possible, at this time, to give a permanent and satisfactory classification of land resources in the United States. The Land Planning Committee of the National Resources Board has, however, offered a tentative preliminary physical classification of productivity, based so far as possible upon soil surveys already made and supplemented by careful estimates of the areas of land in the respective soil groups in the unsurveyed regions. While these surveys are necessarily inaccurate in detail, the classification is offered as the best available information relating to the quality of land in the United States. Table I shows the quantity of land falling within each of the five classes, as tentatively adopted.

TABLE I—PRELIMINARY PHYSICAL CLASSIFICATION OF LAND IN THE UNITED STATES[1]

Grade*	Description	Acres
1	Excellent land	101,038,000
2	Good	210,935,000
3	Fair	345,872,000
4	Poor	362,559,000
5	Non-arable	881,735,000

*Classification made by estimating the acreage of land falling within each class of productivity as based on natural crop-producing power.

The classification covers the entire land surface of the United States regardless of whether or not the land is in farms. It takes into consideration the principal physical conditions influencing productivity, such as soil type, topography, rainfall, and temperature.

Only a small proportion of the land is of excellent or even good quality, while a high proportion is listed as non-arable. Included in the first three classes are 657,845,000 acres. This total is 244,000,000 acres more than is now in crop use and nearly 200,000,000 more than is estimated to be needed in 1960 to support the needs of the anticipated population, with some to spare for export or storage. Some of the Class 4 land can be redeemed by drainage or irrigation, when needed. Much of it can be maintained as good grazing land by wise use and good management.

[1]Based on *Report of the Land Planning Committee*, National Resources Board, Part II.

The Class 5 land is listed as non-arable and should not be regarded as farm land. It does contain some grazing land, which, if properly used, will yield some returns. Much of it is in forest, which is quite as important to material welfare as other forms of crops. A large area of permanent forest land is desirable.

Those wishing to farm will desire to know where to look for land of good quality. It then becomes important to learn the location of these various classes of land. To supply information on this matter, Table II is offered.

Distribution of the Grades of Land. The classification indicates that a very large part of the land classified as excellent lies within the North Central group of states. These are Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas. This area was originally covered by deciduous forests at the eastern border and by the tall grasses on the western prairies. These are all comparatively level to moderately undulating lands that are for the most part free from stone and are easily tilled. The soil is naturally well supplied with the mineral and vegetable materials needed to enrich it. The climate is favorable for crop production, being moderate in temperature and supplied with a bountiful, though not excessive, rainfall. It is, therefore, regarded as very desirable farm land. Many of the other states possess some excellent land but not nearly in the proportions that it is possessed by these North Central states. Four states to the south of this area, Oklahoma, Texas, Arkansas, and Louisiana, possess smaller areas of excellent land. The rest of the land of this class is widely scattered in very small quantities throughout the other states.

The good farm land, as indicated in column 2, is spread throughout nearly all the states. Only Arizona, Montana, Nevada, New Mexico, Utah, and Wyoming are listed as having no land in either the excellent or good groups. These states lie within the mountain ranges or desert regions and have other resources than land which are of great value. Nevada and Utah are the only states possessing no land in any of the first three classes. Their agricultural resources are, therefore, very limited, but even in these states there are many areas capable of redemption. Many of the fertile valleys are already under irrigation and producing abundantly. The Grade 5 land, some of which is possessed by all the states, is of little value for agricultural purposes. It does hold possibilities of wealth from other sources. Forest lands, rich mines, recreation areas, wildlife refuges, and land for other social

TABLE II—PRELIMINARY INVENTORY OF LAND PRODUCTIVITY CLASSES OF THE UNITED STATES[1]

State	Grade 1 acres	Grade 2 acres	Grade 3 acres	Grade 4 acres	Grade 5 acres
Alabama	....	3,002,499	9,528,183	10,730,251	9,490,887
Arizona	....	....	....	949,313	71,916,087
Arkansas	1,452,484	7,952,405	9,231,149	8,299,905	6,707,425
California	46,976	478,297	3,364,517	13,380,327	82,347,163
Colorado	....	285,670	7,041,281	13,743,839	45,270,330
Connecticut	48,452	338,620	902,062	962,120	850,826
Delaware	....	222,080	350,784	417,216	273,280
Florida	71,161	933,187	3,928,412	12,892,726	17,077,968
Georgia	....	1,851,537	15,614,067	9,750,361	10,368,603
Idaho	....	87,288	949,208	3,728,908	43,581,156
Illinois	14,777,030	6,847,145	6,223,171	6,621,568	960,998
Indiana	5,262,498	6,438,377	7,743,581	2,436,801	1,153,367
Iowa	25,983,110	6,906,158	1,392,680	1,007,416	344,556
Kansas	3,765,287	15,172,236	15,964,703	11,207,323	6,094,867
Kentucky	863,916	5,020,424	8,956,319	7,905,826	2,877,195
Louisiana	1,289,430	2,972,742	7,346,623	12,442,991	5,024,118
Maine	....	1,615,033	3,788,506	5,791,456	7,977,805
Maryland	143,732	1,874,527	1,445,544	1,859,409	972,532
Massachusetts	11,906	759,807	1,274,906	1,644,453	1,367,488
Michigan	2,251,155	8,961,198	5,386,738	7,228,991	13,223,254
Minnesota	12,022,243	12,138,815	7,511,325	6,898,992	13,144,839
Mississippi	844,230	5,336,459	8,614,697	10,928,882	4,090,950
Missouri	8,674,763	13,833,050	12,303,627	4,258,868	4,914,778
Montana	....	....	7,366,681	30,438,292	55,565,267
Nebraska	8,120,907	9,690,068	9,639,648	10,908,321	10,757,984
Nevada	....	....	....	76,900	70,200,480
New Hampshire	2,330	237,212	370,426	1,671,601	3,478,271
New Jersey	6,272	943,267	963,896	1,379,108	1,471,016
New Mexico	....	....	914,304	6,060,748	71,426,858
New York	94,037	6,863,934	9,248,628	9,172,273	4,925,960
North Carolina	....	1,166,506	11,360,152	9,381,729	9,285,453
North Dakota	....	7,365,682	17,715,865	14,151,534	5,679,955
Ohio	4,214,074	6,234,205	10,439,723	3,809,973	1,374,625
Oklahoma	1,700,604	12,795,160	15,268,765	7,825,536	6,856,079
Oregon	342,536	2,059,425	4,694,454	5,464,700	48,567,845
Pennsylvania	177,151	6,268,104	9,496,900	5,908,804	6,909,469
Rhode Island	....	5,463	2,28082	71,019	378,316
South Carolina	....	296,359	7,069,969	7,127,990	5,022,890
South Dakota	3,052,320	8,775,365	8,960,392	15,552,419	12,821,104
Tennessee	902,258	4,769,847	9,305,437	8,239,726	3,412,108
Texas	1,591,147	19,460,508	54,974,391	35,950,166	56,098,156
Utah	....	....	....	1,233,459	51,364,301
Vermont	33,217	900,588	1,268,238	2,185,398	1,451,919
Virginia	....	3,653,134	9,279,761	7,312,200	5,399,769
Washington	83,520	542,138	6,537,431	6,760,172	28,836,291
West Virginia	388,551	1,350,227	2,986,643	7,647,077	2,827,790
Wisconsin	2,820,276	14,529,981	8,396,995	4,564,307	5,271,021
Wyoming	....	....	522,936	4,577,769	57,314,015
Total	101,037,573	210,934,728	345,871,800	362,559,173	881,735,414
Percentages	5.3	11.1	18.1	19.1	46.4

[1] Report of the *Land Planning Committee*, National Resources Board, Part II, p. 127.

purposes may well be provided generously from this grade.

Use Made of Crop Land. The crop land so far in use is devoted to a wide range of crops. All are important, but some are much more important than others. The percentage of total crop land used in the production of each and the quantity of each product will give an idea of their relative importance in the national production program. The average acreage of the principal crops grown in the United States in the period 1945 to 1949 is given in Table III.

By far the largest acreage of land, 24.6 per cent, is used for corn production. Hay production takes second rank and wheat stands third in area of land used in production. Cotton, which normally has had the highest money value of any crop, stands fifth in acreage. It is followed by barley, grain sorghums, and sorghums for silage, in order. No attempt has been made to state separately the number of acres devoted to vegetable crops.

Future Needs for Land. The land now in cultivation has been wrested from forests and prairies as needed by rapidly increasing population. The prairie lands have been especially easy to convert into grass lands and farms. As a consequence, more farm land has been developed and tilled than is required to supply national demands for agricultural commodities. Until the world-wide economic collapse in the early thirties, large quantities of wheat, cotton, tobacco, and meat products were grown for the export trade. Following 1930, there was a gradual decrease in agricultural production due to low domestic and foreign demand and decreased purchasing power. It resulted in a tendency toward less intensive land use. This lull, however, was temporary and with the revival in foreign and domestic demand that came with the outbreak of World War II agricultural production was stepped up to the highest level ever attained.

Restrictions on immigration and a declining birth rate resulted in a declining rate of population increase that continued up to World War II. Social scientists predicted that a stationary population would be reached during the second half of the present century and possibly some decrease would occur. These predictions have not materialized. The population of the United States increased by 19,000,000 from 1940 to 1950. This is the largest increase in a ten-year period in our history. There will be a need for more crop land than is now in use but it will not be in proportion to the increase in population. During the period of rapid agricultural expansion, land was brought into tillage that should

TABLE III—AVERAGE HARVESTED ACREAGE OF LAND USED IN CROP PRODUCTION IN THE UNITED STATES, AVERAGE PRODUCTION OF PRINCIPAL CROPS AND PERCENTAGES OF LAND USED FOR EACH CROP, 1945-49 [1]

Crop	*Average Acreage Harvested 1,000 Acres*	*Average Production Thousands*	*Percentage of Total Crop Land Harvested*
Corn	86,661	3,114,887 bushels	24.6
Oats	40,869	1,409,846 bushels	11.6
Barley	10,751	272,835 bushels	3.1
Grain sorghums	6,544	116,839 bushels	1.9
Wheat	71,270	1,217,689 bushels	20.3
Rye	1,825	22,790 bushels	0.5
Buckwheat	387	6,518 bushels	0.1
Rice	1,673	78,564 bushels	0.5
Flaxseed	3,997	39,174 bushels	1.1
Cotton	21,132	12,085 bales*	6.0
Tobacco	1,764	2,079,287 pounds	0.5
All Hay	74,544	102,164 tons**	21.2
Sorghum forage	5,584	7,728 tons	1.6
Sorghum silage	650	3,941 tons	0.2
Beans, dry	1,726	17,708 bags***	0.5
Peas, dry field	433	5,207 bags***	0.1
Soybeans	10,404	204,424 bushels	3.0
Cowpeas	563	3,387 bushels	0.2
Peanuts	3,085	2,091,019 pounds	0.9
Sugar beets	756	10,256 tons	0.2
Sugar cane	422	6,417 tons	0.1
Potatoes	2,282	429,721 bushels	0.6
Sweet potatoes	600	58,254 bushels	0.2
Truck crops (21 crops)	3,662	....	1.0
Total Acreage (44 crops)	351,584	....	100.0%

[1] Compiled from *Crops and Markets*, U. S. D. A. 1950 Edition, Vol. 27.
* 500-pound bales.
** All tons mentioned in this table are short tons. *** 100-pound bags.

have remained in grass or forests. There is a tendency at the present time to return the submarginal land to forest, grazing land, game preserves, and other less intensive uses. To offset this withdrawal, there will be concentration and more intensive tillage of the good land, with increased production per acre. The Land Planning Committee of the National Resources Board estimated that possibly 55,000,000 acres of new crop land may be needed by 1960. A part of this addition will offset 25,000,000 acres of poor land recommended for withdrawal from cultivation and a part to support the expected increase in population. It is probable that the 443,000,000 acres of crop land thus available will fully supply all domestic needs with some to spare for such export trade as may eventually be recovered. The extent of tillable crop land of excellent to fair quality can easily be increased to 500,000,000 acres, should population needs or foreign demand require it. An-

other 500,000,000 acres of land in the United States physically capable of satisfactory crop production can be converted into farm land. This land is now in forests or cut-over forest land, in marsh lands, which may be drained, or in land that can be brought under irrigation. Most of this land should be left in forest or in other forms for the support of animal life at small expense. It can be reclaimed as needed. There appears to be little danger of a shortage of crop land in the United States.

WEALTH CREATED IN AGRICULTURAL PRODUCTION. Farming is a wealth-creating process. The crops grown and the young animals raised annually assume the form of new wealth which did not previously exist. They supply articles that are wanted and sometimes badly needed by human society. An attempt is made annually by the United States Department of Agriculture to express in terms of money the value of the farm products to society. Estimates are made of the quantities produced, sold and consumed in farm households. These quantities are multiplied by average annual prices to give amounts in value of each. The cash income from sales and the value of commodities consumed in farm households are combined to show the total Gross Income. Because of interfarm sales of certain classes of commodities by farmers to farmers, the total farm income tends to overestimate the income actually received. A study of farm income is, however, of great value in learning the sources of the nation's agricultural wealth.

The gross income from agricultural production by sources for the years 1946, 1947, 1948, and 1949 are shown in Table IV. These are the immediate post World War II years. They were characterized by a high level of production and by the highest level of farm product prices in history. The production of individual commodities varied widely from year to year as did also their prices but the gross income of agriculture as a whole for each of these four years was relatively stable and exceeded that of any previous year. Preliminary estimates for 1950 indicate that this high level of income was continued for a fifth year. However the prices of commodities purchased by the farmer have also been rising so that the purchasing power of the farmer's income has not risen proportionately. Prices as well as volume of production determine the farmer's gross income but the price level of the goods and services the farm buys determines the purchasing power of that income.

TABLE IV. Cash Farm Income and Value of Products Consumed on Farms Where Produced in the United States by Commodities, 1946-49 [1]

Commodity	Cash farm income and value of products consumed on farms where produced [2]			
	1946 1000 dollars	*1947* 1000 dollars	*1948* 1000 dollars	*1949* 1000 dollars
Crops				
Wheat	1,666,745	2,590,899	2,508,547	2,175,320
Rye	24,317	43,862	31,504	18,008
Rice	139,979	160,448	170,442	159,077
Buckwheat	3,379	5,143	3,168	1,867
Total food grains	1,834,420	2,800,352	2,713,661	2,354,272
Corn	855,718	1,376,089	1,165,311	1,379,840
Oats	303,365	329,915	305,845	238,988
Barley	189,398	272,130	232,410	176,583
Grain sorghums	86,291	112,161	110,218	138,879
Hay	222,496	230,108	317,783	284,639
Total feed crops	1,657,268	2,320,403	2,131,567	2,218,929
Cottonlint	1,257,707	1,905,927	2,214,068	2,380,326
Cottonseed	204,394	336,745	353,357	256,565
Total cotton and cottonseed	1,462,101	2,242,672	2,567,425	2,636,891
Tobacco	955,306	1,029,709	945,306	904,068
Flaxseed	83,762	226,028	323,952	153,791
Peanuts	169,218	205,639	229,149	188,291
Soybeans	455,304	555,613	489,289	457,475
Tung nuts	5,564	4,909	2,989	3,859
Total oil-bearing crops	713,848	988,189	1,045,379	803,416
Dry edible beans	136,480	179,574	143,281	156,533
Dry field peas	26,828	28,694	17,906	10,770
Mung beans	1,025	718	552	291
Potatoes	512,835	551,499	649,074	517,731
Sweet potatoes	106,633	96,904	83,326	87,423
Truck crops	1,692,712	1,853,555	1,698,235	1,580,704
Total vegetables	2,476,513	2,710,944	2,592,374	2,353,452
Citrus:				
Grapefruit	86,119	55,518	28,265	55,268
Lemons	46,357	53,642	36,675	47,578
Limes	841	754	697	1,093
Oranges	319,684	223,766	154,406	201,873
Other [3]	133	74	58	119

[1] Adapted from Table 673, Agricultural Statistics, U.S.D.A. 1948 and Table 683, Agricultural Statistics, U.S.D.A., 1950.

[2] Quantities of farm products consumed directly in farm households, valued at the average price received by farmers for the sale of similar commodities.

[3] Kumquats and tangeloes.

TABLE IV. Cash Farm Income and Value of Products Consumed on Farms Where Produced in the United States by Commodities, 1946-49 [1]

Commodity	Cash farm income and value of products consumed on farms where produced.[2]			
	1946 1000 dollars	*1947* 1000 dollars	*1948* 1000 dollars	*1949* 1000 dollars
Crops				
Non-citrus:				
Apples	347,586	314,287	254,350	256,315
Apricots	37,389	18,302	15,508	13,751
Avocados	6,555	5,924	7,701	6,242
Cherries	70,227	40,893	49,567	43,616
Cranberries	27,465	16,252	9,814	7,566
Dates	3,629	1,123	2,093	2,325
Figs	14,604	7,554	6,147	6,764
Grapes	290,949	153,844	123,019	97,882
Olives	17,975	6,368	8,423	6,445
Peaches	183,977	133,561	133,975	106,758
Pears	86,342	79,413	63,996	46,902
Plums	20,069	16,929	14,686	11,594
Prunes	59,989	54,527	31,762	29,126
Strawberries	94,003	87,917	108,725	87,683
Other berries [4]	93,956	92,736	122,455	100,706
Other [5]	3,017	1,797	1,769	1,387
Total fruits	1,810,866	1,365,181	1,174,091	1,130,993
Almonds	18,371	16,060	14,348	12,324
Filberts	3,243	2,603	1,581	2,473
Pecans	25,949	29,618	21,812	20,749
Walnuts, Persian	39,826	23,216	29,480	27,540
Total tree nuts	87,389	71,497	67,221	63,086
Alfalfa	34,921	20,123	24,593	32,516
Alsike clover	6,924	6,550	6,922	5,660
Cow peas	7,578	7,748	8,349	6,180
Kentucky bluegrass	4,885	7,267	3,848	5,295
Ladino clover	1,285	1,366	3,211	4,304
Lespedeza	11,860	10,378	16,350	12,627
Red clover	28,494	22,714	29,110	25,623
Sweet clover	3,228	2,892	4,164	3,929
Timothy	3,266	2,861	1,748	5,600
Other [6]	27,022	23,962	31,897	34,149
Total legume and grass seed	129,463	105,861	130,192	135,883
Sugar beets	110,855	152,430	97,262	105,409
Sugar cane for sugar	35,892	36,111	36,385	40 566
Sugar cane sirup	37,871	23,783	13,151	10,872
Sorgo sirup	25,381	17,372	12,776	10,343
Maple sirup and sugar	4,622	10,818	7,100	7,385
Total sugar and sirup crops	214,621	240,514	166,674	174,575

[4] Boysenberries, blackberries, dewberries, loganberries, youngberries, currants, gooseberries, and all others.

[5] Persimmons, pineapples, pomegranates, nectarines, bananas, quaras, jujubes, mangoes, papayas, prickly pears, quinces, sapodil'as, and loquats.

[6] Austrian winter peas, bent grass, Bermuda grass, blue lupine, brome grass, chewing fescue, crested wheat grass, crimson clover, meadow fescue, mustard, orchard grass, rape, red fescue, red top, rye grass, sudan grass, sunflower, tall fescue, vetch, and white clover.

TABLE IV. CASH FARM INCOME AND VALUE OF PRODUCTS CONSUMED ON FARMS WHERE PRODUCED IN THE UNITED STATES BY COMMODITIES, 1946-49[1]

Commodity	Cash farm income and value of products consumed on farms where produced.[2]			
	1946 1000 dollars	*1947* 1000 dollars	*1948* 1000 dollars	*1949* 1000 dollars
Crops				
Broom corn	12,538	10,096	9,261	9,524
Hops	33,361	33,998	27,591	21,584
Forest products	290,298	460,231	316,964	266,696
Greenhouse and nursery prod.	355,081	406,729	429,324	413,184
Other[7]	22,417	20,632	24,573	17,433
Total misc. crops	713,695	931,686	807,713	728,421
Total Crops	12,055,490	14,807,008	14,341,603	13,503,906
Livestock and Livestock Products				
Cattle and calves	3,793,431	4,998,640	5,325,525	4,896,060
Hogs	3,449,346	4,633,905	4,307,450	3,662,024
Sheep and lambs	366,488	406,151	418,687	359,981
Total meat animals	7,609,265	10,038,696	10,051,662	8,918,065
Eggs, chicken	1,728,947	2,073,106	2,154,149	2,106,144
Broilers	270,015	272,788	387,391	416,664
Chickens, other	828,970	753,484	737,261	679,563
Turkeys	273,724	242,733	258,800	269,718
Other poultry[8]	39,814	36,799	40,896	38,973
Total poultry and eggs	3,141,470	3,378,910	3,578,497	3,511,062
Total dairy products[9]	4,449,566	4,845,320	5,303,041	4,515,938
Wool	118,639	106,106	114,072	106,874
Other[10]	113,995	114,923	90,908	75,419
Total livestock	15,432,935	18,483,955	19,138,180	17,127,358
Total crops & livestock	27,488,425	33,290,963	33,479,783	30,631,344
Government payments[11]	771,680	313,813	256,505	185,453
Grand Total	28,260,105	33,604,776	33,736,288	30,816,797

[7] Flax fiber, hemp, peppermint, popcorn, and spearmint.
[8] Ducks, geese, guineas, pigeons, quail, pheasants, and all other.
[9] Value of home consumption determined by applying milk-equivalent price received for products sold to home-consumed milk; not available for separate items.
[10] Horses, mules, honey, beeswax, bees, and mohair.
[11] Payments under dairy, sheep, and lamb and beef production, agricultural conservation, Sugar Act, and price parity programs.

POINTS TO NOTE IN TABLE IV. The data offered in table IV deserves careful study and analysis. It is largely self-explanatory. It may be well to note some of the items making up the farm income. Wheat and cotton head the list with corn in third place.

PLATE I. A WELL-DEVELOPED FARMSTEAD

The farmstead is the center from which a farm is operated. One that is well-proportioned, with buildings conveniently placed and arranged, contributes much to the economy of operation. Courtesy Univ. of Minnesota.

PLATE II. A TYPICAL TRUCK GARDEN

Truck farms are usually developed near large population centers. They are characterized by small fields highly fertilized and intensively cultivated. Courtesy N. J. Agr. Ext. Service.

Plate III. Down in the cotton fields

A scene from the "Old South." Hand-picking cotton on a Georgia cotton farm. Machine cultivation and picking are rapidly replacing hand labor on the larger farms. Courtesy Ga. Agr. Ext. Service.

Plate IV. In the hard spring wheat region

Large machine and power units have revolutionized wheat production. Here a windrowing machine cuts the wheat in preparation for the "pick up" combine thresher which follows when the wheat is dry.

The total value of the corn crop exceeds that of wheat and cotton but since a large part of the corn crop is fed to livestock, much of the income from corn comes indirectly in the form of livestock sales. Tobacco, which ranks fourth, has neither food nor feed value and may well be classed as a luxury crop. Wheat, cotton, and tobacco are non-perishable commodities that command a world market whereas practically all the corn crop is produced primarily for domestic consumption. No attempt has been made to indicate separately the value of all of the fruit, vegetable and seed crops although in total, they represent a very substantial part of the gross income of the American farmers.

Attention may well be called to the fact that each year the total income from all classes of livestock exceed by three to five billion dollars the income value of all crops. It should be remembered that livestock are a means of marketing crops and much of this income from livestock is merely indirect income from crops. The soil is our basic source of wealth and crops are the farmers medium for extracting this wealth from the soil. Livestock provide a means for converting these crops into income.

CHAPTER V

AGRICULTURAL PRODUCTION AREAS

Why is it that most of the oranges are grown in California and Florida? Why is it that the farmers of the South do not raise sufficient wheat and corn for their own needs? Why is it that cotton, peanuts, and sweet potatoes are not grown in the North Central states? Why is it difficult to grow peaches, pears, and apricots in Minnesota or Wisconsin? Why is wheat the principal cereal crop in the Great-Plains area? Why does the state of Iowa grow so much corn? The answers to these questions and many others will be found in a study of the varying physical conditions prevailing in the different parts of the United States. Close examination and analysis of the Figures shown in this chapter will reveal many interesting facts about the agriculture of the United States.

PHYSICAL CONDITIONS DETERMINE PRODUCTION

Physical conditions have a fundamental influence in determining where the various agricultural crops and commodities may be successfully grown. These physical factors are fixed and unalterable. While there may be variations in some of these factors at times, they are, in the long run, quite beyond permanent change or human control. They have been classified into four principal groups as follows:[1]

(1) *Moisture Conditions.* These include rainfall, snowfall, hail, fog, humidity, and rate of evaporation.

(2) *Temperature Conditions.* These cover temperature ranges through the growing season and particularly the dates of spring and fall frosts.

(3) *Topography or Land Form.* This covers the levelness or roughness of the earth's surface, the degree of slope on side hills and the general form of the earth's surface.

(4) *Soil Conditions.* Soil conditions include physical structure and chemical and bacteriological characteristics.

Moisture and temperature determine the climate or atmos-

[1] O. E. Baker, *Economic Geography*, Vol. II, Part 4. U.S.D.A.

pheric conditions of a region. Topography and soil relate to the form and composition of the earth's surface, the land. The climatic factors influence the development of systems of farming, while the soil factors govern more particularly the best use to be made of a farm or a particular piece of land under the climatic conditions prevailing at its location. The soil factors often determine whether the land should be left in forest, used for pasture, or brought under extensive or more intensive cultivation. Physical conditions become increasingly important as population increases and as agricultural development and forestry become more highly organized and commercialized, with large numbers of people dependent upon others for abundant production of food supplies.

THE IMPORTANCE OF MOISTURE CONDITIONS. A statement was made in Chapter IV that without water, that is, moisture, there could be no life. The quantity of moisture present in any area determines to a large extent the scarcity or abundance of life in it and the character of the products that may be grown.

The first settlements in the United States were in the eastern wooded portion where moisture is abundant. The movement westward began about the middle of the nineteenth century. As settlers moved westward into the tall-grass and short-grass prairies, they found it much easier to develop farms than it had been where forests had first to be cleared away. As a result there was rapid expansion westward to the Mississippi River and eventually across it into the short-grass plains. Improved methods of tillage and the development of drouth-resistant and adapted varieties of crop plants permitted extension of the area available for crop production well into the semi-arid areas of the Great Plains. The development of rapid transportation lines across the plains and to the West Coast has also been a factor in opening large areas of land that is easily tilled, but some of which is located where moisture conditions are limited. Because of limited precipitation and soil moisture, cropping in some areas of the Great Plains region is attended with much risk.

The suitability of the varying soils and sites to the production of special crops or products must be studied closely, especially with reference to moisture conditions as balanced against moisture requirements. Competition for the better land will become keener as population increases. The good land will increase in value, making necessary increased production from it. This tendency will require that the use of the land be adapted to the mois-

ture conditions with great care and precision if crop failures are not to occur.

It will be helpful in this connection to study closely Figure 2, showing the average annual precipitation over the United States. It gives the variations in moisture conditions in different areas and supplies part of the answers to the questions asked at the beginning of this chapter.

The Atlantic and Gulf Coast regions receive abundant precipitation, varying from 60 inches or more at the south end of the Florida peninsula and in southern Mississippi and Alabama,

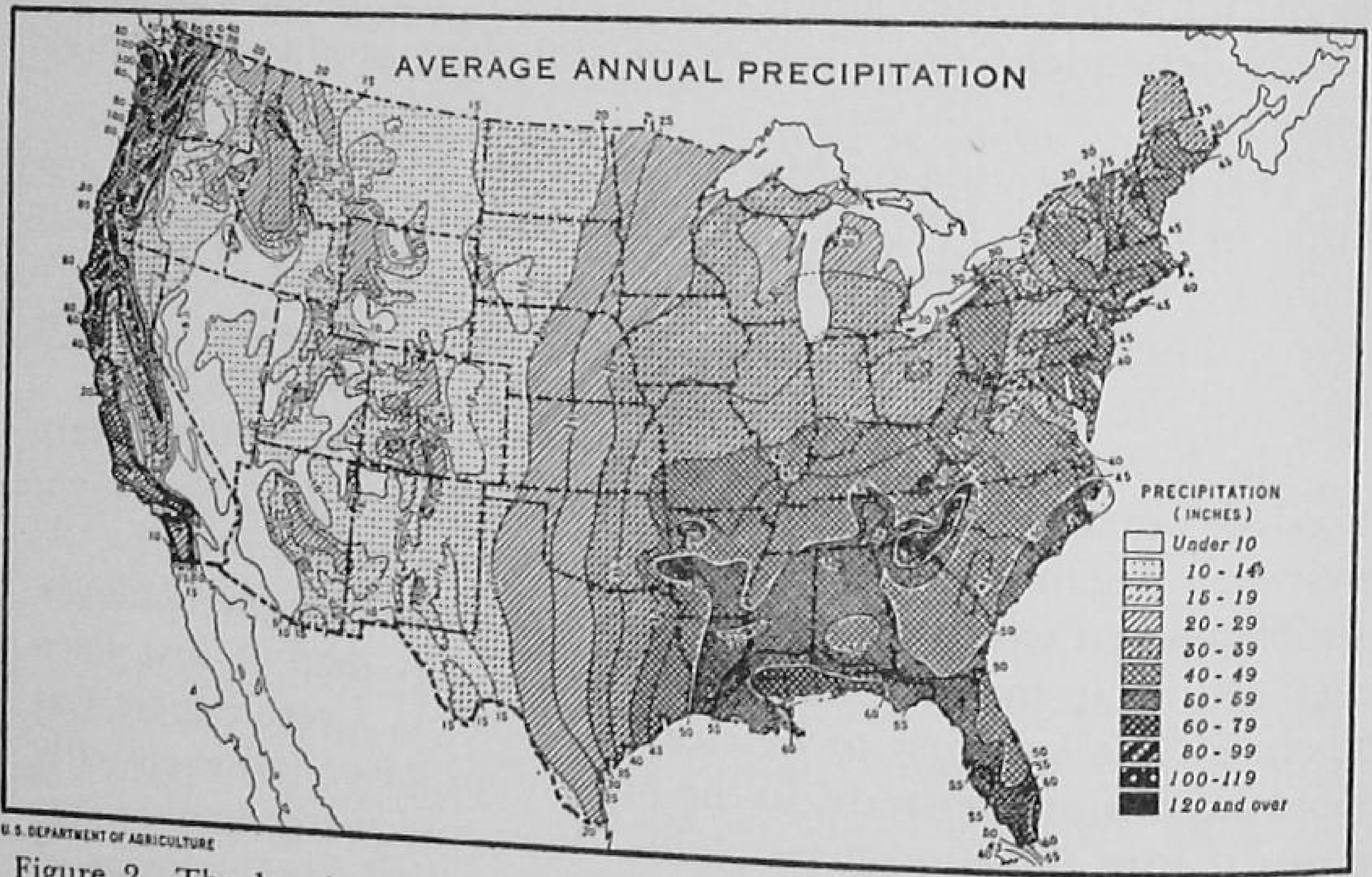


Figure 2. The heaviest precipitation is in the Southeast and along the Eastern Coast. Precipitation west of Pierre, South Dakota, and Amarillo, Texas, is too low for sure production of crops. The open land is used largely for grazing.

to as little as 40 inches at the more northerly points on the Atlantic Coast. The precipitation is carried well westward in the latitudes south of the Ohio River. Most of the area south of the Ohio and east of the Mississippi receives 40 inches or more in annual precipitation. North of the Ohio and east of the Mississippi to the Allegheny Mountains, 30 to 40 inches of rainfall, or its equivalent, is precipitated annually. Precipitation becomes progressively less toward the center of the continent, until at approximately the 100th meridian of longtitude, extending from the Canadian line through the center of North Dakota to Pierre, South Dakota; Dodge City, Kansas; and the eastern line of the panhandle of Texas to the Mexican border, the minimum requirement for cereal crop production is reached (about 20 inches).

West of that line to the Rocky Mountains precipitation is so low as to make crop production uncertain. The greater part of the area should be used for grazing lands and forests. Some favored valleys within the area may well be used for farming purposes, finding an outlet for the products largely in the mining and manufacturing industries lying within the area. Precipitation in the Rocky Mountains and in the area between the Rocky and Coast Ranges is too light to permit cereal crop production, except

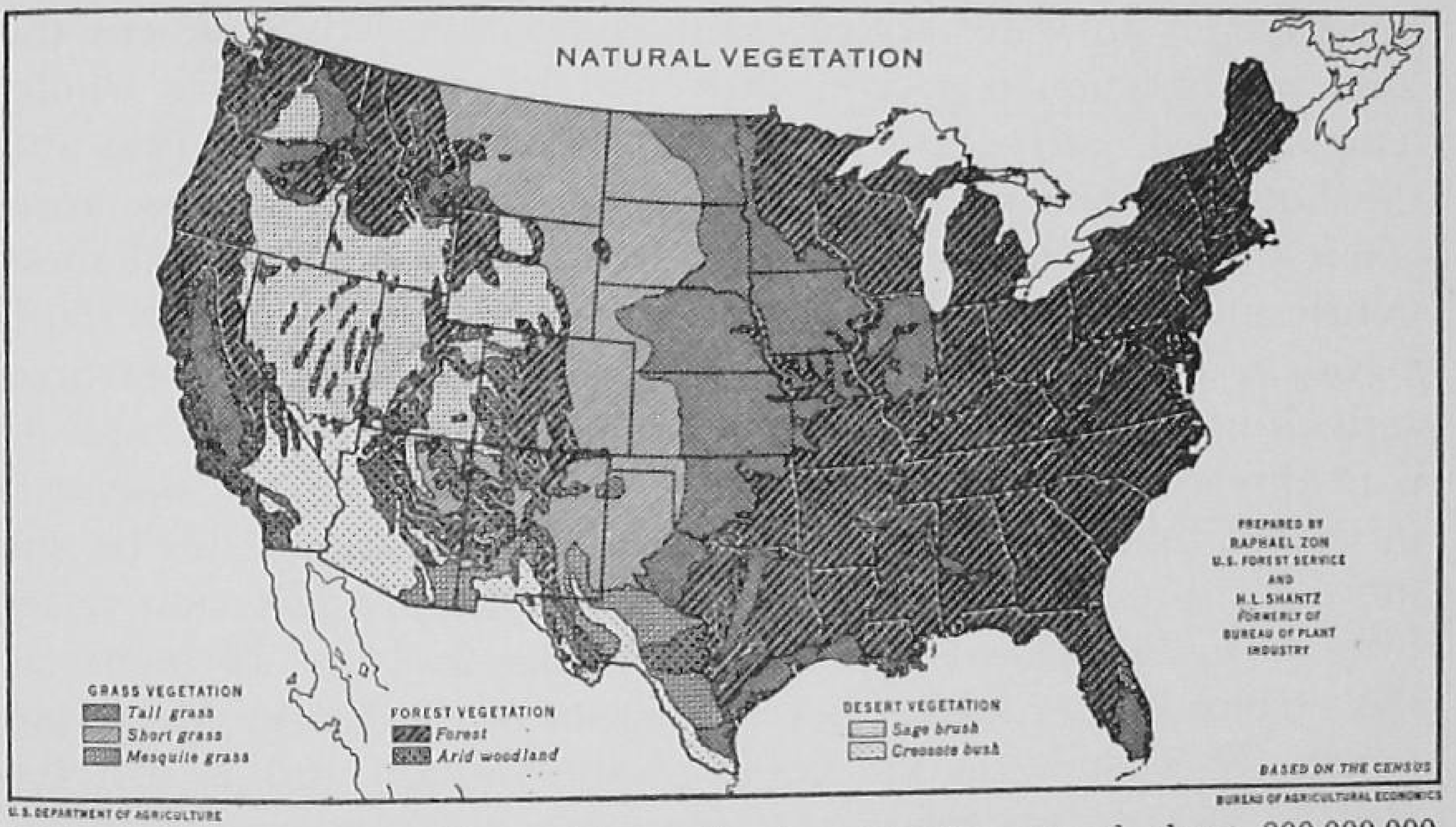


Figure 3. Forest, excluding arid woodland, originally covered about 800,000,000 acres in the United States. Of this, about 350,000,000 acres have been cleared for agricultural production and an even greater acreage has been cut over, burned or destroyed.

in favored spots. Precipitation varies from 10 to 15 inches over the greater part of the region. A small area in the North is favored with 20 to 40 inches. A much larger area in the South has only 10 inches or less. Plant growth there is scarce and only plants requiring little moisture can be produced.

West of the Coast Ranges precipitation again reaches high quantities, particularly toward the North. The northwestern coast of Washington has 100 inches or more. Rainfall is carried well eastward to the mountains, which prevent its further movement in that direction.

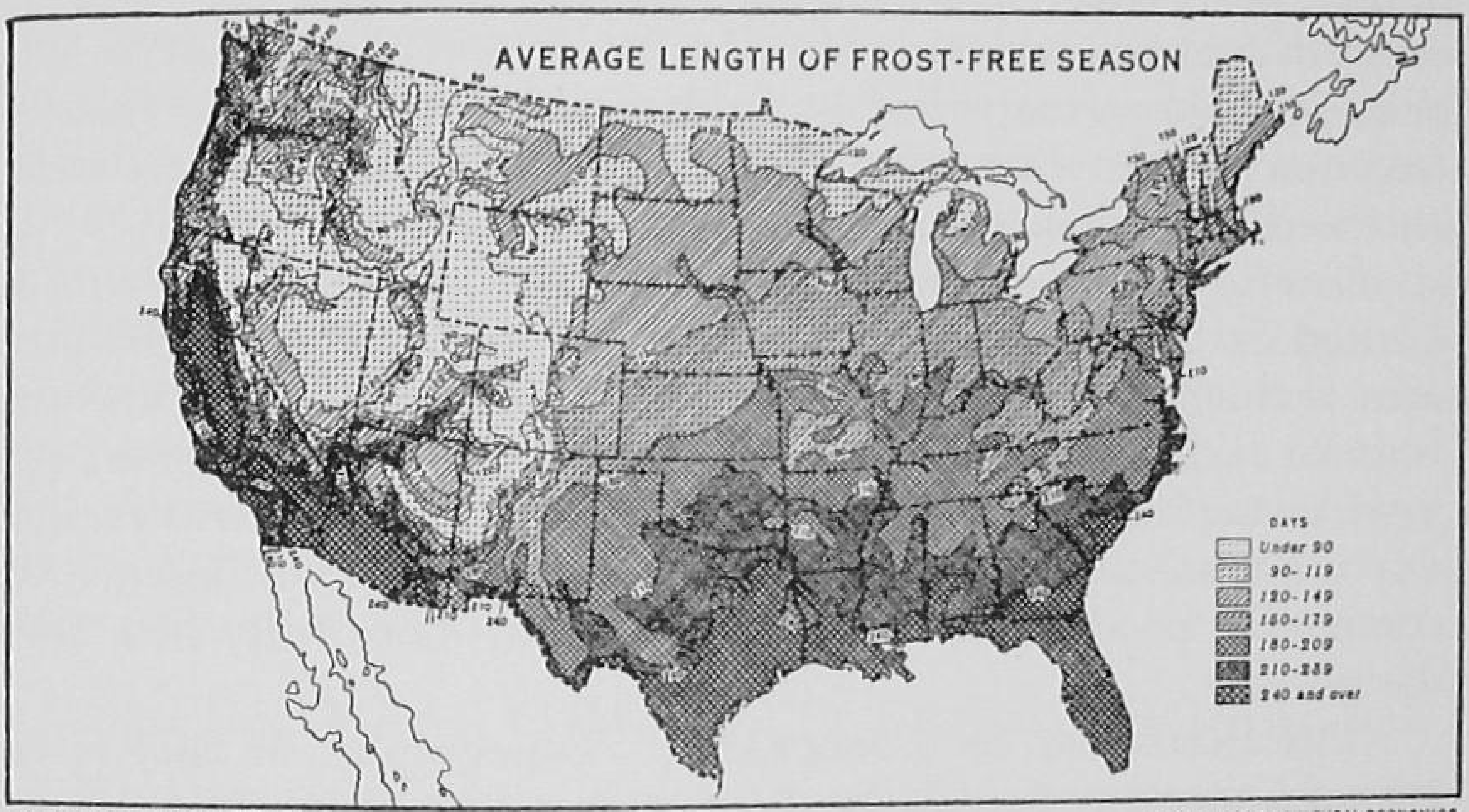
References to Figure 2 indicate that the United States is divided into an eastern humid, or well-watered, area and a western semi-arid, or dry, area. The influence of these natural phenomena may be noted by referring to Figure 3, which shows the natural vegetation which originally covered the land.

Adaptation of Crops. The quality of the land and its potential use are indicated roughly by the native vegetation growing upon it. About 800,000,000 acres of the land surface of the United States were originally covered with forests. About 700,000,000 acres were covered by native grasses, interspersed with various herbaceous plants, and 400,000,000 acres were characterized by desert vegetation. The forests are found in those regions in which the annual precipitation is 40 inches or more. Wood lands are found in areas where the precipitation is less, but they are confined largely to water courses and favored localities, where the local precipitation is greater than that for the area as a whole. The so-called prairie lands are divided between the tall-grass and the short-grass prairies. Tall-grass prairies are found in those areas where the precipitation runs from 20 to 40 inches. One of these prairie plains extends from Illinois westward to about the 100th meridian and south to the Ozark Mountains. This is a favored agricultural region for the production of food and feed crops. It is in this area that the most productive and profitably operated farms are found. To the west of these tall-grass prairies lie the short-grass prairies, or Great Plains. Here the precipitation varies from 18 to 20 inches at the eastern border to 14 or 15 inches at the western border, which lies at the foot of the Rocky Mountain range. This land was the home of the buffalo and is still the favorite short-grass grazing area for cattle and sheep production. The native vegetation at times has been seriously impaired by overgrazing and by the resulting wind and water erosion.

The adoption of soil conservation practices in recent years, together with higher precipitation, has restored the grass cover over much of the area. Controlled grazing is being advocated and to some extent practiced, as a means of permanently preserving good quality grazing lands. The northern and central prairie areas are the more favored farm and range areas.

The southern gulf plains, lying south of the Ozarks and at the end of the Appalachian Mountains, is another fertile region well adapted to farming. Because of the greater rainfall in this region, forests are more abundant and the land more difficult to clear and operate. The eastern area, from the Mississippi River to the Atlantic Coast, the Rocky Mountain region, and the Pacific Coast region, to a large extent, were the original forest areas. Many of these forests have been cleared in the process of developing farms. Large portions have been destroyed by mismanagement, overcutting, and overburning. Forest crops, however, are still natural

crops for these regions and are quickly restocked unless the land is kept under cultivation. Throughout all the mountainous regions are small openings, or prairies, and rich valleys which lend themselves well to agricultural production. In some of these valleys in both the Allegheny and the Rocky Mountain ranges are found our choicest fruit and vegetable lands. These, however, will be discussed in a later chapter.



U. S. DEPARTMENT OF AGRICULTURE   BUREAU OF AGRICULTURAL ECONOMICS

Figure 4. Temperatures are the most rigid limiting factor in crop production. They are affected by latitude and almost as much by altitude. Temperatures in the Mountain Regions are low as they are affected by the high altitudes in many instances.

THE EFFECT OF TEMPERATURE CONDITIONS. Temperatures are of great importance in determining what crops and products can be produced to the best advantage in a region. The plants of certain crops are more susceptible than those of other crops to frost injury. Some crops require a longer time than others in which to ripen or mature to the desired stage of forage, grain, or fruit. The length of the growing season, therefore, becomes a vital factor in determining what crops it may be safe to attempt to produce. The true grasses grow best in moderately cool temperatures. Other plants, such as cotton and corn, grow best in moderately hot temperatures. The length of the growing season is determined for most crops by the time elapsing between the last killing frost of spring and the first killing frost of fall. This time varies in the United States from 90 days or less, in some of the mountainous areas of the Northwest, to 240 days or more in the southern and coastal areas. See Figure 4.

Winter temperatures are also a factor in determining what perennial crops may be successfully produced. Certain forage crops, such as lespedeza and some varieties of alfalfa, will not live through the extremely low winter temperatures that frequently prevail in the North. Certain varieties of winter wheat that mature safely and yield well in the southern latitudes will not survive the severe winter temperatures of the North. Fruit trees, such as peach, pear, cherry, and tender varieties of apples are likely to winterkill at temperatures of –15° to –20°, if the cold is of long duration and accompanied by limited moisture supply. Thus, it becomes evident that temperature operates as a definite barrier in the distribution of many crops.

Careful study of the climatic conditions prevailing in the United States, as shown in Figures 2 and 4, indicates that the area is roughly divided not only into the eastern humid and the western arid area, but into (1) a cold northern humid region, (2) a warm southern humid region, (3) a cold northern arid region, (4) a hot southern arid region. The effect of this difference on commodity production will be brought out more fully in a later discussion.

THE INFLUENCE OF TOPOGRAPHY. Topography, or land form, has an important bearing on the use that should be made of the land. Hilly regions, when converted from grass lands or forests into tillable lands, erode badly and soon lose their fertility. In addition, these lands are difficult to work and poorly adapted to the use of modern farm machinery. While they can be and are used to some extent in agricultural production, they are clearly at a disadvantage. A unit of man labor can care for at least twice the area on level land adapted to the use of machinery that it will care for on rough or hilly land. Because of the danger of erosion as well as of the increased cost of cultivation, land having a slope of fifteen feet or more in one hundred feet distance should not be used as crop land. It may do well for grazing land and pasture, but it should not be used for the production of tilled crops. Where the slope is as much as twenty-five feet in one hundred feet distance, it is preferable to keep the land in forest. Soils on such slopes are usually shallow and infertile and, if tilled or even used for pasture, are likely to wash badly. Large quantities of the richest surface soil from rough land farms are annually carried down the Ohio and Missouri Rivers to the Mississippi and down the Mississippi to the Gulf of Mexico. Obviously, this loss should be prevented so far as possible by keeping such lands cov-

ered with forest trees or with hardy grasses. In view of the extensive use of machinery now in practice, the level surfaces in the Mississippi Valley and in the semi-arid regions of the Great Plains have higher economic value than could be attributed to them on productive power alone.

Natural Soil Fertility. The natural fertility of the soil and its physical structure are extremely important considerations in crop production. The soil is the home of the plant and thus is the basis for all plant growth. Inherently, fertile land is more enduring than a less fertile one. A unit of labor or capital applied to its cultivation will give the highest possible returns. On account of this capacity and better productivity, the best farm land is in greatest demand and will, therefore, at the same time, carry a much heavier population load than the poor soil. There is a tendency, consequently, for the best grade of land to be first occupied and most intensely tilled. There is a tendency also, eventually, for the best farmers to acquire possession of the best land. These factors greatly influence the final disposition and permanent utilization of the land.

AGRICULTURAL COMMODITY PRODUCTION AREAS

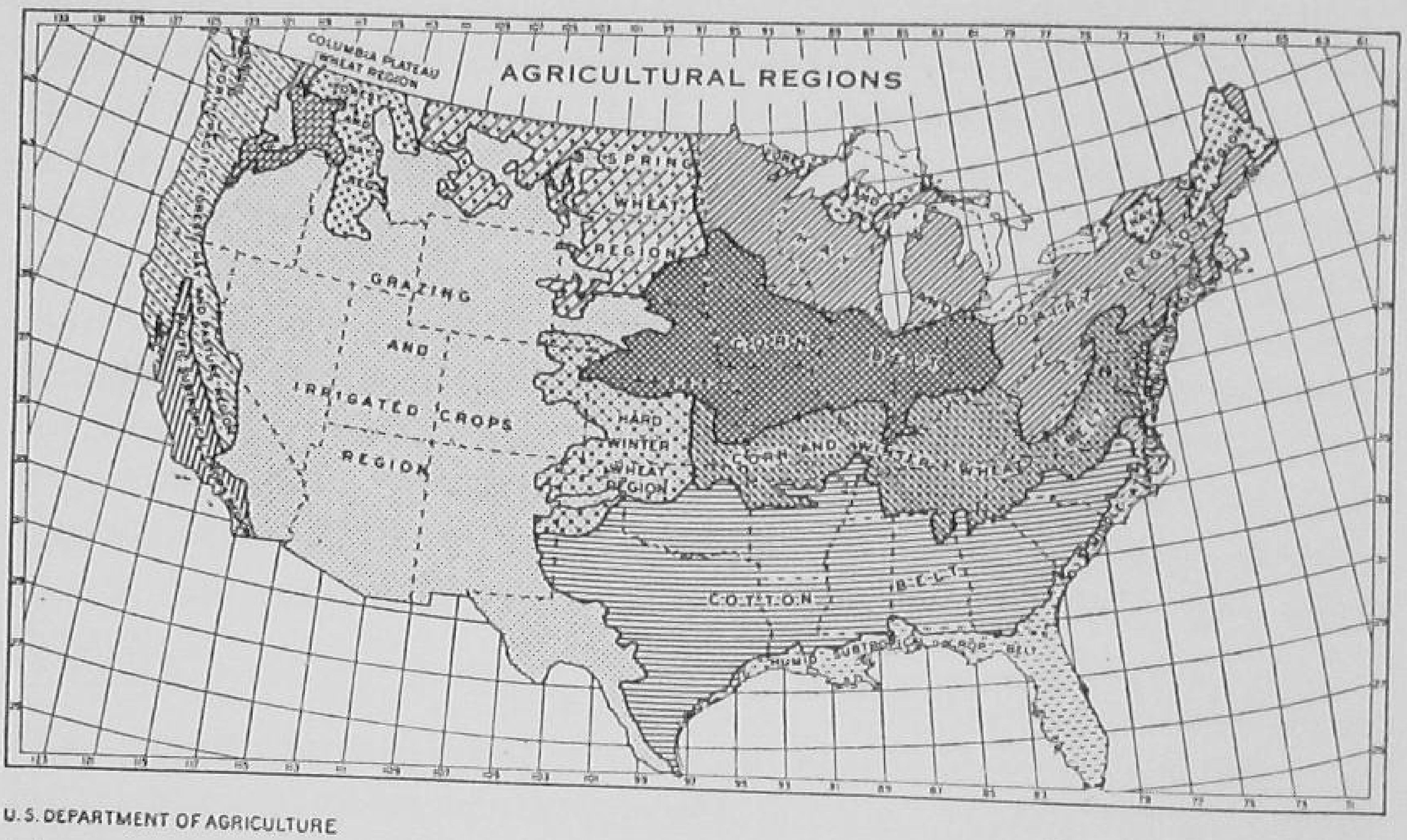
The net result of the physical conditions just described, modified to some extent by economic forces, which will be referred to later, is the establishment of certain well-defined areas where the production of some one or more commodities dominates the farming. These are indicated in Figure 5.

The United States lies within the temperate region of North America. This is a region of great agricultural importance. It composes what is probably the greatest agricultural area in the world, not only in size but in quality and quantity of crops produced. On the basis of crops grown, this area has been divided into thirteen principal crop belts, or sections, where specific types of agriculture are predominant to a large extent. These belts are largely determined by temperature, though they are modified definitely by variations in rainfall, topography, and by soil quality, which features are important items in the production of any commodity. The principal crop belts as indicated on the map are (1) the Humid Subtropical Belt; (2) the Cotton Belt; (3) the Middle Atlantic Truck Crop Belt; (4) the Corn and Winter Wheat Belt; (5) the Hard Winter Wheat Belt; (6) the Corn Belt; (7) the Hay and Dairy Region; (8) the Spring Wheat Region; (9) the Grazing and Irrigated Crop Region; (10) the

Western Forest and Hay Regions; (11) the Columbia Plateau Wheat Region; (12) the North Pacific Forest, Hay, and Pasture Region; and (13) the Pacific Subtropical Crop Region.

ADAPTATION TO PHYSICAL CONDITIONS

Some crops, such as oranges, need a long, frost-free season, abundant sunshine, and liberal moisture supplies to mature their fruit. Other crops, such as wheat, do not thrive in hot humid



U. S. DEPARTMENT OF AGRICULTURE

BUREAU OF AGRICULTURAL ECONOMICS

Figure 5. The United States may be divided agriculturally into two parts, the East and the West, on the basis of the prevalent use of the land, whether for crops or for pastures. The dividing line apporximates longitude 103°, except that it trends southeasterly in Texas and northwesterly in Montana.

temperatures and mature in a relatively short season. Cotton, sweet potatoes, and peanuts must have a long season at warm, but not excessively hot, temperatures. Peaches, pears, and apricots are sensitive to low temperatures and winterkill badly in north central latitudes. Wheat may be grown in a wide variety of climates, but the best market quality of wheat is grown on the clay loam soils of the grass prairies in the cooler latitudes. More corn is grown in Iowa than in any other state, because it has large areas of level land of high quality and is located where prevailing temperatures, rainfall, and sunshine favor the corn crop. Machinery is used extensively in producing both wheat and corn crops and the level prairie and plains are well adapted for machine operation. Thus it is seen that moisture and temperatures largely determine where various crops can be grown to advantage. Soil quality and land topography modify and limit areas to some

extent. Economic factors also, such as population density, market and transportation facilities, influence but do not so rigidly limit commodity production areas. A discussion of some of the characteristics of these areas follows.

THE HUMID SUBTROPICAL BELT. This belt embraces a narrow strip of land running from the extreme southern part of Texas across the south end of Louisiana, Mississippi, Alabama, and Georgia. It also embraces the entire state of Florida. Subtropical fruits, such as oranges, lemons, grapefruit, pears of the tender varieties, and many of the small bush and vine fruits are grown in this area. Rice, peanuts, and sugar cane are also successfully produced. Rainfall varies from 40 to 60 inches, with high temperatures and a growing season of 240 days or more. The altitude is little above sea level and the soil is sandy and low in fertility. Large quantities of commercial fertilizers are required to secure satisfactory production.

THE COTTON BELT. The Cotton Belt includes the greater part of Texas, Oklahoma, and Arkansas, and all Mississippi, Alabama, Louisiana, Georgia, South Carolina, and North Carolina. Some cotton is produced in the southern part of states bordering on the north of the states named. Rainfall in the Cotton Belt ranges from 60 inches to as little as 25 inches in western Texas and Oklahoma. The growing season ranges from 240 to 180 days, which is the lower limit for maturing a cotton crop. The area is favored with a fertile soil, though subject to erosion and leaching from heavy rainfall. It is regarded as one of the most favored cotton-producing areas in the world. The cotton crop has been one of the chief export commodities of the United States. It has, at the same time, furnished the raw material for the great cotton-goods factories of New England and the Southern states. The cotton crop, including both lint and seed, easily takes first place in value in the gross farm income of the nation.

While cotton is the chief and most important crop in this region, there are many other products. Among them are rice, sugar cane, sorghum, peanuts, cowpeas, and velvet beans. Tobacco is produced in South Carolina, and corn, for home consumption. The corn is of low yield and more starchy than that produced in the Corn Belt. Some livestock is raised, but not sufficient for the needs of the population. Livestock production is steadily increasing, however, as better sanitation measures are introduced and forage crops become better adapted.

THE MIDDLE ATLANTIC TRUCK CROP BELT. Truck farms ex-

tend in a narrow belt along the entire Atlantic Coast from South Carolina to the New England states. This belt is also the seat of many great industrial activities. Factories and open seaports give employment to great numbers of people. This region is densely populated and agricultural land is relatively limited. Farms are small and the soil is not especially productive, though well watered. The principal products are vegetables and fruits, which find a ready market in the near-by urban centers. The land, well suited to the so-called truck crops, is intensively tilled. Large quantities of commercial fertilizer are used annually to stimulate rapid growth and high yields.

THE CORN AND WINTER WHEAT BELT. The Corn and Winter Wheat Belt, beginning in southeastern Pennsylvania, stretches westward to southeastern Kansas, largely but not entirely between parallels 35 and 39. It includes parts of Pennsylvania, nearly all Maryland, Virginia, Tennessee, and Kentucky, and smaller portions of Ohio, Indiana, Illinois, Missouri, Arkansas, Oklahoma, and Kansas. The lines drawn in delineating these belts are approximations only. There is no distinct separation of one belt from another, but a gradual merging of one area into the other.

The Corn and Wheat Belt has a relatively high rainfall, ranging from 35 to 50 inches. Most of the area receives more than 40 inches annually. It is a region of mild winters and an average growing season of 180 days. Since the Ohio River Valley traverses the area, the topography is rolling to rough, particularly at the eastern end. As a result of heavy precipitation and the long open season, soil erosion is a constant menace, particularly where intertilled crops are grown. The soil, however, is productive where well conserved.

As the name of this belt suggests, corn and wheat are the most important products grown. The corn is of good quality. Wheat is fall-sown and of the soft red winter class, which is of low gluten quality and used largely for hot breads and pastry cooking. Tobacco is an important product of the area. Kentucky is the principal center for the commercial crop, though Virginia, Pennsylvania, Tennessee, Ohio, and Maryland grow considerable quantities. Forage crops are abundant and good grass pastures are much more prevalent than in the Cotton Belt to the south. Kentucky is the home of Kentucky bluegrass, the leading pasture and lawn grass through the northern states. Because of the large areas of forage and pasture crops, livestock production takes on great importance in this belt.

THE HARD WINTER WHEAT BELT. This is a relatively small area including the western two thirds of Kansas, northwestern Oklahoma, Texas, and small parts of New Mexico, Colorado, and Nebraska. Difference in precipitation and in soil formation distinguishes this area from the Corn and Wheat Belt. The rainfall varies from 30 inches at the eastern border to as little as 15 inches at the western. The growing season ranges between 150 and 180 days. The soils are alkaline and underlaid with limestone and shale rock. The topography, for the most part, is level to slightly rolling and the land easily tilled. Farms are large and large machinery is used extensively. Tractor power is used on tandem-hitched tillage and seeding machinery for putting in the wheat crop. The combine harvester-thresher is the commonly used device for harvesting the grain. Low cost production is the result on farms of 2,000 to 3,000 acres. Many are much larger.

The wheat is fall-sown and harvested the following summer. The grain is much harder, with strong gluten and better suited to bread-making than the soft winter wheats. This difference is accounted for by the soil quality, the limited rainfall, and the prevalence of sunny weather during the ripening period. While the area is relatively small, it is of great importance in providing the wheat supply of the nation.

Other crops supplementing wheat production in the area are corn, barley, sugar beets, grain sorghums, field beans, and alfalfa. Grazing lands are interspersed with wheat farms in some parts of the area. Cattle and sheep raised on the grass ranges are sold as feeders to farmers in the Corn Belt for finishing. They may be grain-fed for the market while on summer pasture.

THE CORN BELT. The Corn Belt begins in eastern Ohio and stretches westward to Kansas at the southwest and to South Dakota at the northwest. It lies between the Corn and Winter Wheat Belt on the south and the Hay and Dairy Region on the north. It covers most of Indiana and Illinois, the northern part of Missouri and Kansas, the eastern half of Nebraska, and the whole state of Iowa. It extends northwestward to include southeastern South Dakota and southwestern Minnesota. The development of early-maturing varieties of corn combined with adapted hybrid varieties, and improved cultural practices are steadily drawing the Corn Belt northward and westward into the Spring-Wheat Area. Accompanying this movement has been a steady increase in cattle and hog production in the area which furnishes the chief outlet for the corn crop.

Reference to Table II shows that a large part of the excellent farm land of the United States lies in this area. In addition to the fertile soil, the topography is level and well suited to the use of tillage machinery. Because it is level, erosion is not a serious menace, even though much of the land is used in the production of corn and other intertilled crops. It is without doubt the most favored agricultural region in the United States in respect to soil and climate. Probably no other area in the world possesses physical conditions so favorable for the production of Indian corn.

The annual precipitation of the area ranges between 40 inches in the easterly and southerly portions to 25 inches in the more westerly and northerly parts. Fortunately, the greater part of the precipitation, 60 to 80 per cent, is in the form of rainfall during the spring and summer months. The length of the growing season ranges from 180 days in the south and east to 130 days in the more northerly parts.

The heaviest concentration in corn production centers in Iowa and Illinois, which are regarded as the center of the Corn Belt. These two states alone normally produce nearly one third of the total United States corn crop. While some corn is sold on the cash corn market, by far the larger part is grown as feed for livestock, which is heavily concentrated throughout the Corn Belt. Hogs and beef cattle consume 55 per cent of the corn crop in the United States and are invariably found in large numbers wherever the corn crop is grown. The great meat packing-house markets at Chicago, Kansas City, Omaha, South St. Paul, and St. Louis are outgrowths of the corn and livestock production of the Corn Belt.

Other important crops of the area are oats, wheat, barley, and tame hay, which includes alfalfa, alsike and red clover, timothy, and other grasses.

THE HAY AND DAIRY REGION. This is a long and irregularly shaped area, extending from the eastern New England coast westward along the Canadian border and south of the Great Lakes to the Corn Belt on the south and the Spring-Wheat Region on the west. Wisconsin, Minnesota, and New York, in the order named, lead in dairy production; with northern Illinois and northeastern Iowa contributing substantial quantities of whole milk to the Chicago market. Dairying is a major enterprise also in eastern Ohio, West Virginia, New York, a large part of Pennsylvania, and in those sections of the New England states not occupied by forests or used for intensive truck and fruit crops. The northerly

latitude gives this area moderate to cool summer temperatures and cold to a severely cold winter season. Precipitation ranges from 25 inches or more in Minnesota to 50 inches in the easterly states. This precipitation is well distributed throughout the growing season, though at times there is a shortage of moisture in some parts during the late summer months. Heavy snowfall is not uncommon in the winter months. The frost-free season ranges from 120 to 150 days.

Much of the land of this area is rolling to rough and mountainous. A large percentage of it is non-tillable and must be kept in forest land or permanently seeded to hay and pasture crops. The abundant rainfall and the cool temperatures are favorable for the growth of the grass and forage crops. Timothy, orchard grass, redtop, bromus, and Kentucky bluegrass in combination with alfalfa, sweet, alsike, and other clovers, yield hay and pastures of excellent quality.

Some of the important crops of this region are oats, barley, rye, wheat, potatoes, beans, sugar beets, and fruits. While corn is grown in parts, it is a relatively minor crop, except as used for fodder or silage in feeding dairy cows.

As will be noted in Table IV, Chapter IV, the income from dairy products is the largest single item in the national farm income. A very large part of the total milk products of the United States comes from this area.

THE SPRING-WHEAT REGION. The Spring-Wheat Region includes the Red River Valley of Minnesota, most of North and South Dakota, and a part of Montana. It extends well north also into the Canadian provinces of Manitoba, Saskatchewan, and Alberta. Here winter temperatures are too low to permit the production of fall-sown varieties, though other conditions are favorable for it. The hard red spring wheat produced is world-renowned for its high content of strong gluten and its excellent milling quality. The flour from this grade of wheat is highly esteemed for making white bread. The great flour mills at Minneapolis and Duluth are built upon the reputation of hard spring wheat grown in the area. Soil and climate combine here as nowhere else to produce this exceptional quality of wheat.

The soil, reclaimed largely from the tall-grass prairies, but extending into the short-grass area in places, is a glaciated clay loam mixture, black to brown in color, overlying a retentive subsoil that is rich in calcium. Precipitation is relatively low, ranging from 25 inches at the eastern border to as little as 15 inches

at the western. About 80 per cent of the precipitation is normally in the form of early summer rains. It is possible, therefore, to grow good crops in spite of a low total. It is necessary to employ moisture-conserving practices, however, in the western areas, to insure satisfactory yields. The frost-free season ranges from 110 to 150 days.

Other crops of importance grown in this region are corn, oats, barley, rye, flax, sugar beets, potatoes, and alfalfa. Sheep, hogs, and range cattle are sufficiently numerous to give variety to the agriculture of the region.

The Grazing and Irrigated Crop Region. This is a large region of great and varied resources, but of minor importance in agricultural production. It extends from the east side of the Rocky Mountains to the east side of the Coast ranges and from northern Montana to the Mexican border. It is of rough topography, varying in altitude from great mountain peaks to deep valleys. Short mountain ranges parallel the Rocky and Coast ranges. Forest trees cover the mountain ranges and some of the better-watered valleys. The plains are covered with bunch grasses, sagebrush, and other desert vegetation. Precipitation is scant, varying from 20 inches in some of the mountain areas to less than 10 inches on the intervening plateaus. As a result of variations in altitude and latitude, temperatures vary greatly. The growing season ranges from 90 days, or less, to as much as 150 days in southern latitudes.

The chief agricultural activity is the production of range livestock. Cattle, sheep, horses, and goats are grazed extensively on the native grasses and other vegetation.

Much of the grazing land is in the public domain or in national forests. Much of it is under the control of the United States Department of Agriculture Forest Service, which leases grazing rights to ranchmen or other livestock producers. Most of the grazing land has been injured by overgrazing, drouth, and wind erosion. As a consequence, 20 to 40 acres are required to provide feed for a mature cow or equivalent in other livestock. These lands, under the control of the Forest Service, are, however, gradually being brought back into good condition. Under good management, they should be kept permanently as grazing lands. Large areas should be converted into national forests.

While most of this area is best used for livestock production, there are many valleys adapted to irrigation, which yield heavily of grains, fruits, and vegetables. Some excellent peach, apple,

and cherry orchards are found in the area and vegetables and melons from these valleys are shipped to the eastern markets. Much of the land of little use for agriculture or grazing contains mineral resources of great value. Gold, silver, copper, and coal have been mined extensively. Oil has been found in places and one of the richest rock phosphate deposits in the world is known to exist in Wyoming, Montana, Utah, and Idaho.

WESTERN FOREST AND HAY REGION. A considerable area of land in northwestern Montana, northern Idaho, and northeastern Washington is naturally adapted to the growth of forest trees and hay crops, particularly alfalfa. As the land is cleared and improved, grains and vegetables, with potatoes and sugar beets, become of importance. Tame-hay production and grazing are, however, the forms of agriculture to which this area is best adapted.

THE COLUMBIA PLATEAU WHEAT REGION. This is a relatively small, but highly fertile area in southeastern Washington, stretching into northern Oregon. It is an area of scant precipitation (15 to 20 inches), but it comes at a time favorable for the growth and harvesting of wheat. The winter temperatures are low, and both winter and spring varieties are raised. The soil is rich and yields of wheat are notably high. In some of the irrigated valleys, apples and pears are important and small fruits are grown to some extent.

THE NORTH PACIFIC FOREST, HAY, AND PASTURE REGION. This region consists of a narrow belt extending along the Pacific Coast from Canada to central California. It is a region of mild temperatures and heavy winter rainfall. The Japanese current along the coast tempers the climate both winter and summer. The winters are mild and the summers cool. The rainfall ranges from 100 inches at the north on the coast to 40 or less at the southern end. Topography varies from rough and mountainous to broad level valleys, with temperatures influenced by altitude.

As will be noted by reference to Figure 3, this area was originally densely forested. Much of it still is and should remain so. Many of the valleys, however, have been cleared and planted to orchard fruits. Apples, prunes, and cherries from these orchards have made the valleys of Washington and Oregon famous. Small fruits and vegetables are produced in abundance. The cool climate and heavy rainfall also favor the production of grass and hay crops. Dairying and the raising of beef cattle are of importance in parts. While this is not looked upon as a grain-raising

area, large acreages of barley, wheat, oats, and rye are produced in the broad valleys suited to these crops.

PACIFIC SUBTROPICAL CROP REGION. This region includes the southern two thirds of California. It is a region of scant rainfall, varying from 10 inches at the extreme southern end to 20 inches, or a little more, at the northern end. But little agricultural production is attempted, unless water for irrigating the land is available. Where it is available and wisely used, vegetation is profuse. Subtropical fruits, such as oranges, lemons, and peaches, are extensively produced. Vegetables are grown in abundance to supply the great metropolitan centers on the coast. The surplus finds its way across the continent to the central and eastern markets or seeks the export market.

✓ CHAPTER VI

ECONOMIC FORCES MODIFY PRODUCTION AREAS

As noted under a discussion of agricultural commodity production regions, in Chapter V, each region produces more than the one commodity for which it is named. Some of the regions produce many commodities in many different combinations on different farms. A close study of farming in any community in any region will show no sharp division lines between commodity regions or between the types of commodities raised on the farms of a region or community. There is much overlapping of lines of production between farms in a community and between the types of farming that may be found adjacent. Farms of different types will be found in nearly every region.

Dairy farms are found in the Cotton and Corn Belts. Corn is raised on farms in the dairy regions. Some farms in the dairy regions get the larger part of their income from raising beef cattle. Likewise, on some farms, even in the ranch country, the larger share of the income will be from a dairy herd. Poultry will be found on nearly all types of farms. Swine production is also quite universal, although it is more highly concentrated in the Corn Belt than elsewhere. Question may well be raised as to why all these variations in a region when the region is naturally so well adapted physically for the production of some one certain commodity. The explanation is due in part to the factor of personal choice and to the capabilities and resources of the farmers, but in a larger measure to the pressures and limitations incident to the economic forces prevailing in the locality. Personal preference is influenced by financial returns.

While physical conditions invariably limit or determine the major lines of production for a region, they do not completely govern the major enterprise [1] or the combination of enterprises that may be included in organizing a farm business. Certain economic forces influence and modify production within a region

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[1] A farm enterprise is any crop, class of livestock, or manufacturing process which constitutes a unit of the farm business. On most farms several enterprises are combined into a well-rounded farm business.

and tend to bring about changes in proportions of production between the various commodities adapted to the prevailing physical conditions. The combined effect of these two groups of forces (physical and economic) tends to develop within the region what may be termed *Types of Farming.* This term is commonly used, but its definite application will be further explained after a discussion of some of these economic forces and their effect in localizing production.

The major economic forces modifying agricultural production may be listed as:

1. Relative demand for the commodities;
2. Labor conditions, as related to supply and wage rates;
3. Availability of capital.

There are other economic forms that influence production, but these are the most important.

1. The relative demand for agricultural commodities, as reflected in prevailing price levels for the commodities, often brings rapid swings from one commodity to another. For instance, when prices for wheat are low and relative prices for corn are high, there is a tendency for farmers in the Corn and Wheat Belts, where either may be raised, to increase the acreage of corn, taking the increased acreage from the land formerly sown to wheat. Should more corn or other feed crops, such as oats or barley, be grown than is required for livestock feeding, prices for these crops will become relatively lower and farmers will swing back to wheat production. The relative demand is usually quickly reflected in changes in prices offered for the commodities. Long-continued low prices for any commodity are likely to lead to lessened production of that commodity.

These examples serve to illustrate the effect of this economic force, if long continued, in shaping the agriculture of a region.

2. Labor conditions in a region also influence production. When labor is scarce and wages relatively high as compared to prices for agricultural commodities, there is a tendency to limit the labor used in agricultural production. When the position of prices for labor and commodities is reversed, labor will again be liberally employed in production. The production of some crops requires much more labor than is required in the production of other crops. When labor is scarce, therefore, there is a tendency on the part of producers to grow those crops requiring the least labor, provided that price relationships are favorable. As labor becomes plentiful or as machinery can be substituted for part of

it, production may shift again to the more intensive forms which call for the use of more labor.

3. Capital in the form of goods for use in production is an important item in farming, as a farm business unit requires certain kinds of equipment for economical operation. Suitable buildings must be provided for the type of farming to be pursued. Livestock for power or productive purposes may be needed. Machinery, tools, and other equipment will be required for efficient and timely cultural operations, if the farm is to be well operated. Lack of capital, whether capital be thought of as equipment or as the money with which to buy it, often prevents full utilization of land and labor.

The above-described economic forces, together with minor ones, greatly influence and modify the farming operations. Careful study of the effect of these forces has led to the recognition of certain well-defined economic principles or laws, which lead to a greater or less degree of economic specialization.

Effect of Economic Factors. American farming has become highly commercialized. Farmers grow or make products which they sell on the open market. With the proceeds from sales they buy from others whatever goods they may need in their business or to satisfy their personal desires and pleasures. Economic factors influence types of farming largely by their effect upon the returns from particular farm enterprises, or combinations of enterprises in relation to the labor, capital, and other resources used. Those combinations of enterprises which for a period of years bring the largest profits to the operator eventually determine the type of farming adopted.

Changes in price levels for commodities and changes in the items of cost connected with production often cause shifts in proportions within the combinations, though they may not change the type of farming. Crop failure in one area or in some other part of the world may justify or necessitate radical changes in production plans because of the effect on prices or costs. Changes in consumption habits, better methods of marketing, the use of trade-marks and advertising, all affect consumption or use and the returns made from the production of the farm commodities. The change from hand labor to machines in many industries has lightened the physical requirements of laborers and has affected their choice of diet and clothing. There is a trend away from the heavier foods toward fruits, vegetables, and dairy products. People wear lighter clothing than when a larger proportion of the

work was done by manual labor. These changes in consumption affect prices at which various farm products sell and in turn cause farmers to produce more of the products which sell at the more favorable prices.

Transportation and freight rates also affect choice of enterprises that go into a farm business, either in the prices at which they sell or in the expense at which they are produced. For these and many other reasons, agricultural production becomes more or less localized and patterned under the forces of certain economic principles or laws which should be generally recognized. The most important of these are next discussed.

THE LAW OF COMPARATIVE COSTS. This is a simple and elementary generalization that should be recognized in any study of agricultural conditions. Holmes[1] states this law as follows:

> The producers of every locality tend to use their resources in the production of those goods in which their costs are comparatively lowest and to buy with the proceeds of this production such of the goods of other producers as they may desire for the satisfaction of their own wants.

The comparison is not made between the cost of production of a given commodity in one area and that of the same commodity in all other possible producing areas, but rather on the basis of comparing the cost of producing a given value of the commodity in a given area with the cost of producing an equal value of any other commodity in the same region or on the same farm. It is not a question of whether or not the cost of producing wheat in Canada is less than that of producing wheat in Kansas, but a question of whether the resources used in producing a bushel of wheat in Kansas would be as fully used and would give as high or higher returns if used in Kansas or on the same farm in the production of corn or some other adapted commodity. By trial, error, and experience, and careful study and calculation, farmers select those commodities that give them the highest net profit and weave them into their production plans, thus making up a type of farm business.

VON THUENEN'S LAW. The effect of transportation on production is expressed through two recognized characteristics of production, namely specific value and degree of perishability. The way in which these two characteristics operate to determine local-

[1] C. L. Holmes, *Economics of Farm Organization and Management* (Boston: D. C. Heath & Co.), p. 47.

ization was first stated by a German economist, Von Thuenen. The law is stated in two parts as follows:

1. Goods which are of low specific value tend to be produced adjacent to the marketing or consuming center; while those of higher specific value are produced at greater distances; and those with the maximum specific value, at maximum distances from market.
2. Goods of a high degree of perishability tend to be produced adjacent to the market; those of a less degree of perishability, at a greater distance; and those which are of high durability, at the maximum distance from market.

This law sounds formal and complex and may be difficult to understand. A brief explanation with illustrations of its effect will make it more understandable. Specific value means simply the ratio between value and mass, or volume. Straw from threshed grain or cornstalks from which the corn has been taken are examples of very bulky materials of very low specific value. Because of their bulk and low value, they can not be transported long distances to market except at a loss. Butter, on the other hand, is a highly concentrated article of high specific value, but it can be shipped long distances to market under proper packing and refrigeration. A study of the price per unit of wheat, corn, hay, potatoes, hogs, milk, and butterfat at some good market point will show that prices are lowest at the points farthest away from the market and that they increase as the important center is approached. There will also be a tendency for the products with the highest value per unit of weight to be produced at the greatest distances from the market center. The same tendency will be noted if the illustration is limited to the dairy industry. Butterfat production, which is the more concentrated form, will be followed in the more remote areas and whole milk will be produced nearest the consuming centers.

Bulky, perishable products, such as garden truck and vegetables, are usually produced near large consuming centers, though modern refrigeration methods and rapid transportation facilities are making it less imperative to move such goods immediately to a local retail market. It is the usual thing to find truck and garden crops closest to the cities. Next in order will be found whole milk and poultry production sections, outside of which will be areas of butter production, livestock feeding, grain-growing, and, on the outer fringe, livestock-grazing.

The Law of Regional Competition of Enterprises. This is another law that should be considered in attempting to find the

reasons for variations in farm production practices within a commodity production region. This law[1] has been stated as follows:

> (When two or more farm enterprises compete for the land and other resources of a given area, prices will tend to be such that the one with the more limited potential area will have its choice of the territory and its area will expand in the direction of less and less favorable conditions for its production until rising costs and lower prices due to increased production will make it unable to extend farther owing to greater profits secured from the competing enterprises.)

An illustration of the effect of this law may be found in the Cotton Belt. Many types of plants and crops can be grown there so far as physical conditions are concerned. Forage crops, to be used in livestock production, may easily be grown. Corn production might readily be increased over much of the region, which would result in greater livestock production. Both forage crops and corn are widely adapted, however, and can be grown not only in the Cotton Belt but in many other regions and particularly in the Corn and Wheat Region and in the Corn Belt. Cotton, on the other hand, can not be grown profitably except where there are 200 or more frost-free days, where summer temperatures are 77° or more, and where the annual precipitation is 20 inches or more, with not more than 10 inches falling in the autumn, or harvest season. The area in which cotton can be grown is much more limited than are the areas in which corn and forage crops grow luxuriantly.

The cotton crop, therefore, is most consistently profitable on the good soils of the Cotton Belt and is given first place in deciding the use to be made of the land. Corn has a wider climatic range than cotton, but narrower than wheat; so it outcompetes wheat in the use of land in the Corn Belt. Other examples are found in the competition between corn and barley as feed crops on the margins of the Corn Belt and between the small grain crops and the native grasses in the Great-Plains area. The crop of greatest potential value in the area and which is most limited in range of adaptation gets first choice of the land.

While there are many other economic forces that influence agricultural production, the three stated above are the most important in determining what enterprises may wisely be included in organizing a farm business into a definite or specific type of farming within the limits of the physical environment.

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[1] C. L. Holmes, *op. cit.*, p. 51.

Chapter VII

CHARACTERISTICS OF TYPES OF FARMING[1]

Great variation in soil and climate tends to localize to a considerable extent the production of agricultural commodities, as shown in Chapter V. Production is still further localized especially by the customs and desires of those who produce them. Agriculture is, therefore, classified within agricultural production areas into Types of Farming Areas. Attention is here called to the meaning of the term and to an analysis of the characteristic requirements of various types of farming.

Types of Farming Defined. The word "type" signifies a characteristic style or kind. Applied to a farm it denotes "a form of organization and a method of operation representative of a group of farms, in which there is a high degree of uniformity in such essential factors as selection of enterprises, farm practice, and method of disposal of products." [2]

A study of farms within any of the agricultural commodity production regions outlined in Figure 5, will reveal that there are many variations in the kinds of farming and in the cultural practices of farm operators. These variations are the result of attempts of individual farm operators to adjust their resources to the immediately surrounding physical and economic environment, so as to obtain the greatest possible return for the capital and labor expended. Changes in crop varieties, new practices of tillage, the introduction of new machinery, infestations of plant or animal diseases, and changes in economic pressures make this matter of adjustment an ever-present problem that is never completely solved. The study will show, however, that there are many farmers in the group studied who include in the farm organization approximately the same crops and livestock, the same production practices, and who dispose of their products with a high

[1] The following discussion of types of farming is based upon a study made by the Bureau of Agricultural Economics from the 1930 census. The census of 1940 employed a different classification of farms and no attempt has been made to revise the charts developed from the earlier census. Minor shifts have doubtless been made but they would affect the charts very little. Drouths and restrictions on production tend also to make the 1940 census a less dependable basis for such charts than the 1930 census.

[2] C. L. Holmes, *op. cit.*, p. 45.

degree of uniformity. These may be said to be following the same type of farming.

Many types of farming are found in each region of the United States, each type being adapted to some particular locality, soil type, climatic condition, and economic influence. For the purpose of studying these types more specifically, it becomes necessary to classify them and describe the characteristics of some of the major ones.

TYPES OF FARMING CLASSIFIED. The United States Census Bureau in taking the 1930 census, adopted what is termed as the "gross income" basis for classifying farms as the best available measure of type. By this term it is meant that the line of production which brings in the major portion of the farm income indicates the type of farming done. (Under this method of classification, if 40 per cent or more of the gross income of a farm comes from one commodity, it is classified under the name of that commodity.) That is to say, if 40 per cent of the income of a farm is from wheat, it is classified as a wheat farm. If 40 per cent or more is from dairy products and dairy cattle, it is classified as a dairy farm; if from cotton, as a cotton farm; if from corn, as a corn farm; if from fruit, as a fruit farm; if from vegetables and garden truck, as a truck farm.

Students reading this chapter may well make a study of the farms in their home community and attempt to classify them by major production commodities. If possible, they should get the co-operation of the County Agricultural Agent and of the instructor, either of whom is quite likely to be able to learn what the major sources of income are on at least a few farms in the community.

CHARACTERISTIC REQUIREMENTS FOR REPRESENTATIVE TYPES OF FARMING

Each type of farming is an outgrowth of the experience of groups of farmers in operating farms under the physical and economic conditions prevailing in a given region or community. Farmers choose crops and livestock adapted to existing physical conditions and from which they get the best returns for capital and labor expended under the prevailing economic forces. The crops and livestock may be produced in varying proportions and in different combinations, but the same general practices of production and marketing are followed. By studying the characteristics of these farms it becomes possible to determine under what

environment each type of farming is most likely to succeed. In deciding where to farm and what kind of farm business it is best to organize, it will be helpful to know the characteristic requirements for successfully operating some of the representative types of farming. These characteristics are discussed briefly in the following pages.

PART-TIME FARMING. Part-time farming is increasing in the United States, particularly in areas surrounding cities. The family may live on a small farm adjacent to the city, grow part of their food requirements and some products for sale, thus getting some cash income from it. The principal part of the family income, however, is from employment in the city. There is also some part-time farming in areas remote from urban centers. Though the occupation may be given as farming, the farm income is supplemented from work at jobs other than farming. These may include road work, lumbering, work in the oil fields, or sometimes in factories at nearby industrial centers. The produce from these farms does not enter largely into commercial trade, but they are a factor in satisfying the needs of the nation for food products.

SELF-SUFFICING FARMS. In the early days of American agriculture, the chief interest of the farm family was to raise food and clothing material for its own use. Each family provided sufficient of the primary needs for its own use and was said to be operating a self-sufficing farm. Self-sufficing farms are still found in large numbers and spread over all parts of the United States. The self-sufficing farms, in general, are small farms simply operated and with no pretense of systematic organization. They usually supply only a meager living to the operator and his family. At the present time, few, if any, self-sufficing farms supply the entire needs of the farmer and his family. Goods of one kind or another must be purchased, and most of these farmers produce some crop or animal product for sale, or they work for others to gain the needed cash money. These farms have little, if any, commercial value to agriculture. That is, the sale of farm products is of minor importance and the commodities produced are used largely by the farm families. Some of the self-sufficing farms shown in dots in Figure 6 are Indian farms, an attempt having been made to make the Indian self-supporting or partially self-supporting through simplified agricultural production.

GENERALIZED FARMS. American agriculture, since the opening of the twentieth century, has become highly commercialized,

and nearly all farmers produce something which they sell for cash, buying with the cash thus obtained many of the articles needed by the family. The general farms are more highly organized than the self-sufficing farms and sell or exchange a much larger part of their farm products. They are called general farms only because less than 40 per cent of the income is derived from any one enterprise.

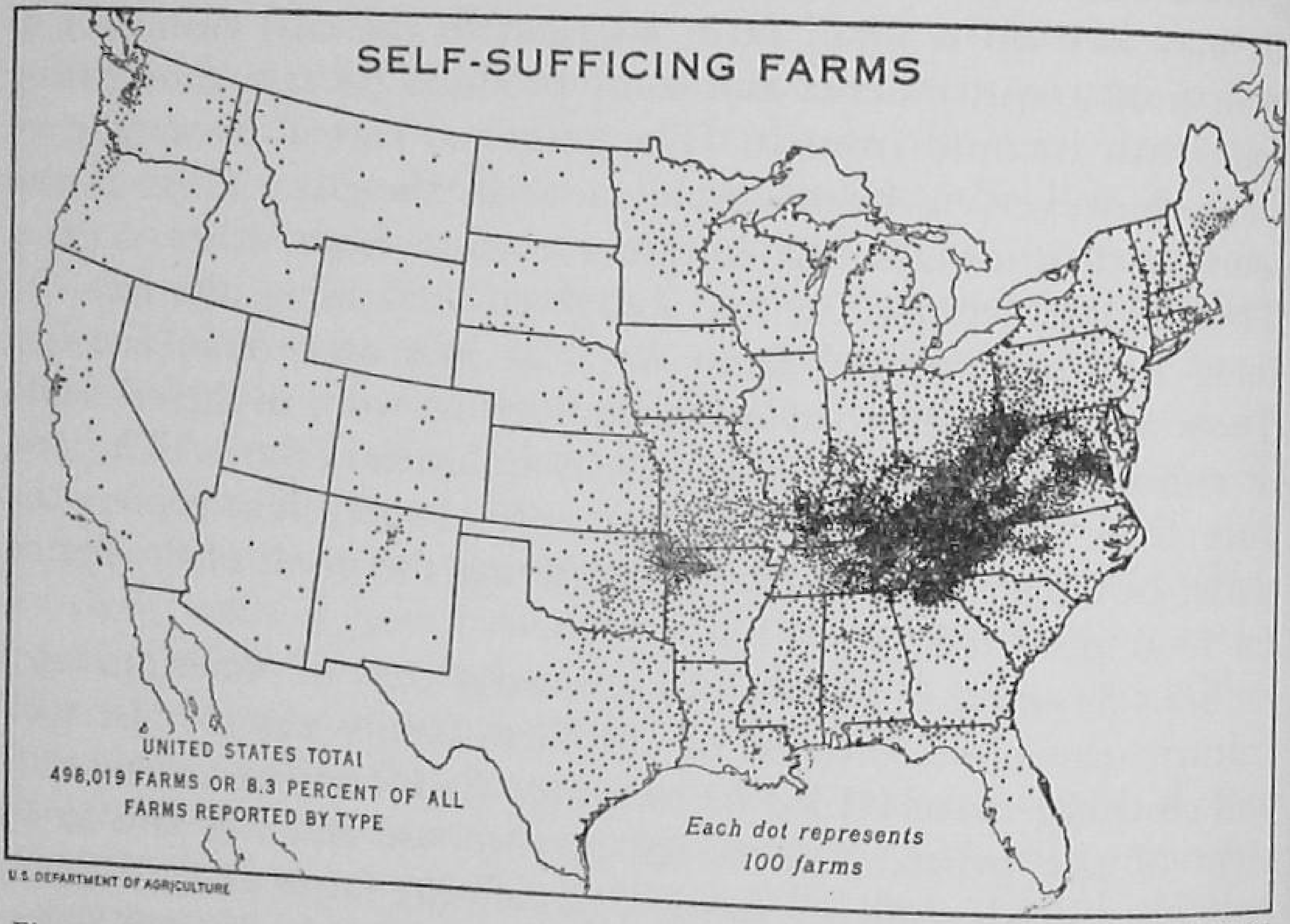

Figure 6. Self-sufficing farms are those where products of less value than those used by the farm family are sold. This type of farm is found most frequently in the region of the Southern Appalachian Mountains, but is also scattered through other sections of the country.

TRUCK FARMING. Vegetables and truck-growing succeed best in a warm, humid climate, where high temperate to subtropical temperatures prevail. It is important that there be a long frost-free period. Precipitation should be generous and well distributed throughout the entire season. In many of the large valley lands, where irrigation water is available, precipitation is not so important, as water is supplied from irrigation ditches. Irrigated truck farming is quite prevalent in many of the mountain areas, particularly in the West and Southwest, where precipitation is decidedly limited, but where temperatures and other conditions for growing vegetables are favorable.

Market gardening and truck growing are intensive forms of

production that require relatively small tracts of land. Many truck farms, located in the vicinity of small industrial centers, range in size from 2 to 10 acres. Near the larger metropolitan centers and in locations where climatic conditions are particularly favorable, they may range much larger. Most truck farms range between 10 and 50 acres in size, though some commercial truck farms may reach 200 acres or more. The larger farms are usually located in especially favorable areas and operated as

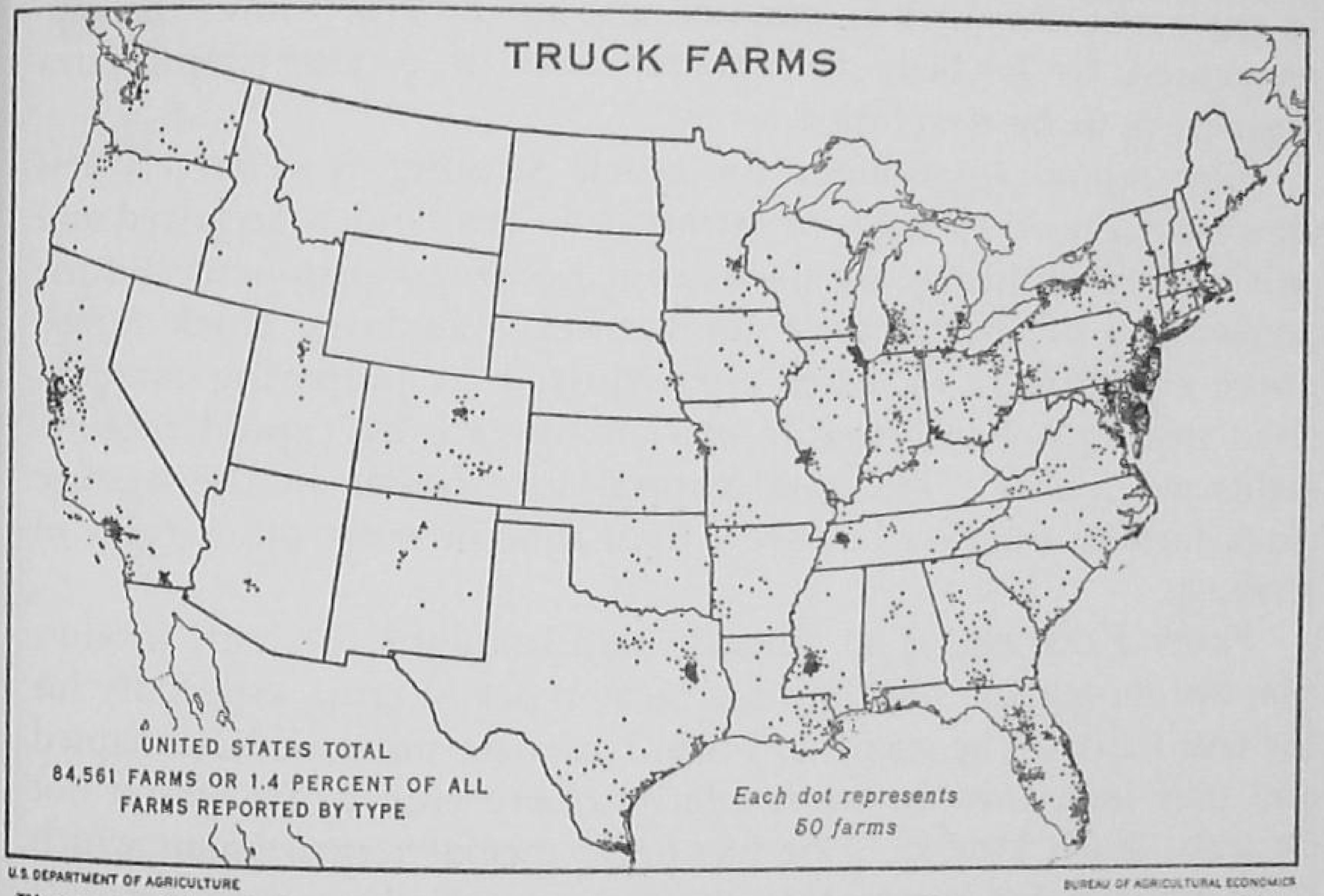

Figure 7. Truck farms are concentrated around centers of dense population. The highest concentration is found along the Atlantic seacoast.

commercial enterprises. Often the produce is shipped under refrigeration long distances to market. It is essential that the soil be warm and of high fertility so that quick growth may be made. It is an advantage to have the land located close to a large population center. Modern transportation facilities, however, make location less important than formerly. By reason of proximity to metropolitan centers and competition for its use, good truck land is usually high priced. Since so little is required, however, truck farming may be conducted with a moderate or small amount of capital, though the capitalization per acre is usually high. Because truck land is kept under constant cultivation and is, therefore, subject to erosion, it is desirable to have land that is level or only slightly rolling. Level land is also much more easily tilled.

Truck growing involves much work that must be done by hand labor. Seed sowing, weeding, harvesting, and preparing the crops for market require close attention, skill and intelligence. Good quality crops must be grown and offered to the market in good condition, as the retail trade is discriminating and often refuses low quality goods. It is difficult to make a year-round business out of truck growing except in locations where temperatures are high throughout the greater part of the year. In any event, the work is seasonal, and in the North must be supplemented by hotbeds and greenhouses if a year-round farm business is to be developed.

The capital investment for truck farming is relatively less than for most other types of farming, as less land is required and only modest buildings are needed for housing equipment and the preparation of the produce for market. On large truck farms, where cold-storage facilities are required in preparing material or in storing it for favorable market operations, capital requirements are higher. The total capital investment in the average truck farm is smaller, however, than that in most other types of farming.

Fruit Farming. The climatic requirements for fruit production are more exacting than for most types of crop, especially for the tree fruits. The small, or bush, fruits are more widely adapted and may be grown in many places where tree fruits would not do well. Each kind of fruit has some special requirement which must be met for greatest success. Study of these requirements is essential before deciding upon a line of production. There is another factor about tree-fruit farming which must be taken into consideration, namely, that trees require five to seven or eight years after planting before they come into production. It is difficult, therefore, to shift quickly out of tree fruits into something else without great loss of capital accumulations. It is important, therefore, that the location be well chosen and that the trees planted are of a kind that will yield fruit for which there is permanent market.

The main fruit areas in the United States are the southern ones in Florida and Texas and those on the Pacific Coast. Other areas where conditions are favorable for producing tree fruits are adjacent to the Great Lakes, particularly those areas adjacent to Lake Michigan, Lake Erie, and Lake Ontario. Certain intermountain regions, such as the Cumberland Shenandoah region of West Virginia, Maryland, and Pennsylvania, the Ozark region of

Arkansas and Missouri, and certain selected areas in other mountain states are also suitable for many of the tree fruits. Specifically, the requirements are for a humid climate, with abundant precipitation throughout the growing season, a long frost-free growing season, moderately warm summers with abundant sunshine during the fall or ripening season, and winters free from great extremes of cold.

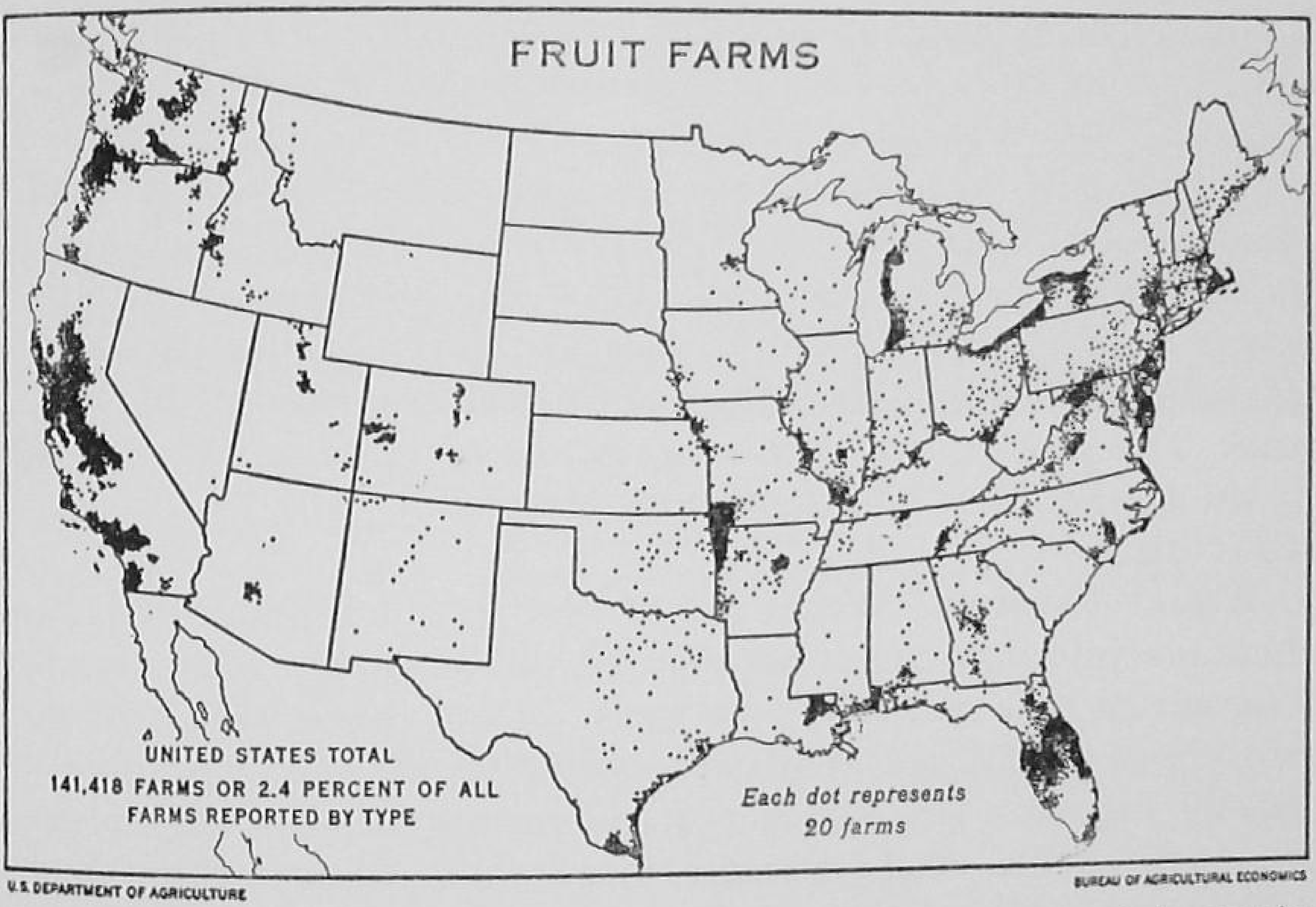

Figure 8. Fruit farming, like truck farming, is highly concentrated in certain favorable areas. The highest concentration is found in the Florida Peninsula, on the California coast and valley lands, and in the North Pacific states. Other centers of high concentration are on the borders of the Great Lakes, particularly in New York, Ohio, and Michigan, and along the North Atlantic coast.

Fruit farms run larger in size than truck farms; but, like truck farms, call for high capital investment per acre because of the costs for buildings and the expense for growing trees, or replacing them when necessary over a long period of time. Most fruit-tree orchards run from 20 to 40 or 50 acres in size. In particularly favorable regions, they may run larger, some reaching as much as 160 to 200 acres. Occasionally, fruit farms will be found that include 500 acres or more. Such farms are the exception rather than the rule.

The roots of fruit trees penetrate deeply and, therefore, do not require an extra rich surface soil. It is essential, however, that the soil be well drained for best results and that, as the

trees come into production, fertility be supplied to insure a full crop of good quality. The topography of the land is not so important, although, to secure air drainage and freedom from frost, high rolling lands are somewhat to be preferred over the lower levels.

Fruit growing requires good management in most localities. No other type of farming calls for greater watchfulness; more careful attention to detail, such as pruning, spraying, and fertilizing; or more business ability. Skill is required in pruning and caring for the trees, in harvesting and packing the fruit, and in protecting the orchards from injury. Like truck-growing, the work is seasonal, with some periods requiring intensive work and other periods but little.

A large part of success in fruit farming depends upon the judgment with which the crop is marketed. Much ability in business management and good salesmanship is essential to good returns. The problems of preparing, grading, packing, and of timing the market must be intelligently understood, else heavy losses will result.

WHEAT FARMING. Wheat grows best in a temperate climate where precipitation ranges between 20 and 30 inches annually. It is important that two thirds, or more, of the precipitation be in the form of rainfall and that it occur during the spring and early summer months. Dry weather at harvesting time is highly desirable to enable wheat growers to produce wheat of the best market and milling quality. Cool nights and sunny days, with light cool breezes in the summer ripening period are favorable influences in maturing the crop. Those areas, or localities, providing these climatic conditions have desirable advantages for the production of wheat. Clay and clay loam soils, containing plenty of available lime and well supplied with the elements nitrogen and phosphorus, will produce the best quality of wheat.

Wheat is grown in large or small quantities in nearly every state in the Union. Only in the northeastern states and in the southeastern Cotton-Belt states is it a negligible crop. In many states it holds a minor place in combinations of crops which make up the general farming type. In only a few areas is wheat production sufficiently concentrated to dominate the type of farming. One of these is the hard red winter-wheat region, centering in the states of Kansas and Oklahoma; with supplementary areas in Texas, Colorado, and Nebraska. Another is the hard red spring-wheat region, centering in the Dakotas, with supplemen-

PLATE V. SUMMERTIME IN THE DAIRY REGION

Ample grass and legume pastures, with abundant water supplies, characterize the dairy region and provide cheap food for dairy cows. Courtesy N. P. Railway.

PLATE VI. A REPRESENTATIVE BARN IN THE DAIRY REGION

Winter dairying calls for warm barns and ample storage room for hay, silage, and other feed stuffs.

PLATE VII. A REPRESENTATIVE CORN FIELD SCENE

Level fields and rich soil, coupled with favorable climatic conditions, characterize the corn belt. Large machines and power units result in low-cost corn production. Courtesy John Deere Co.

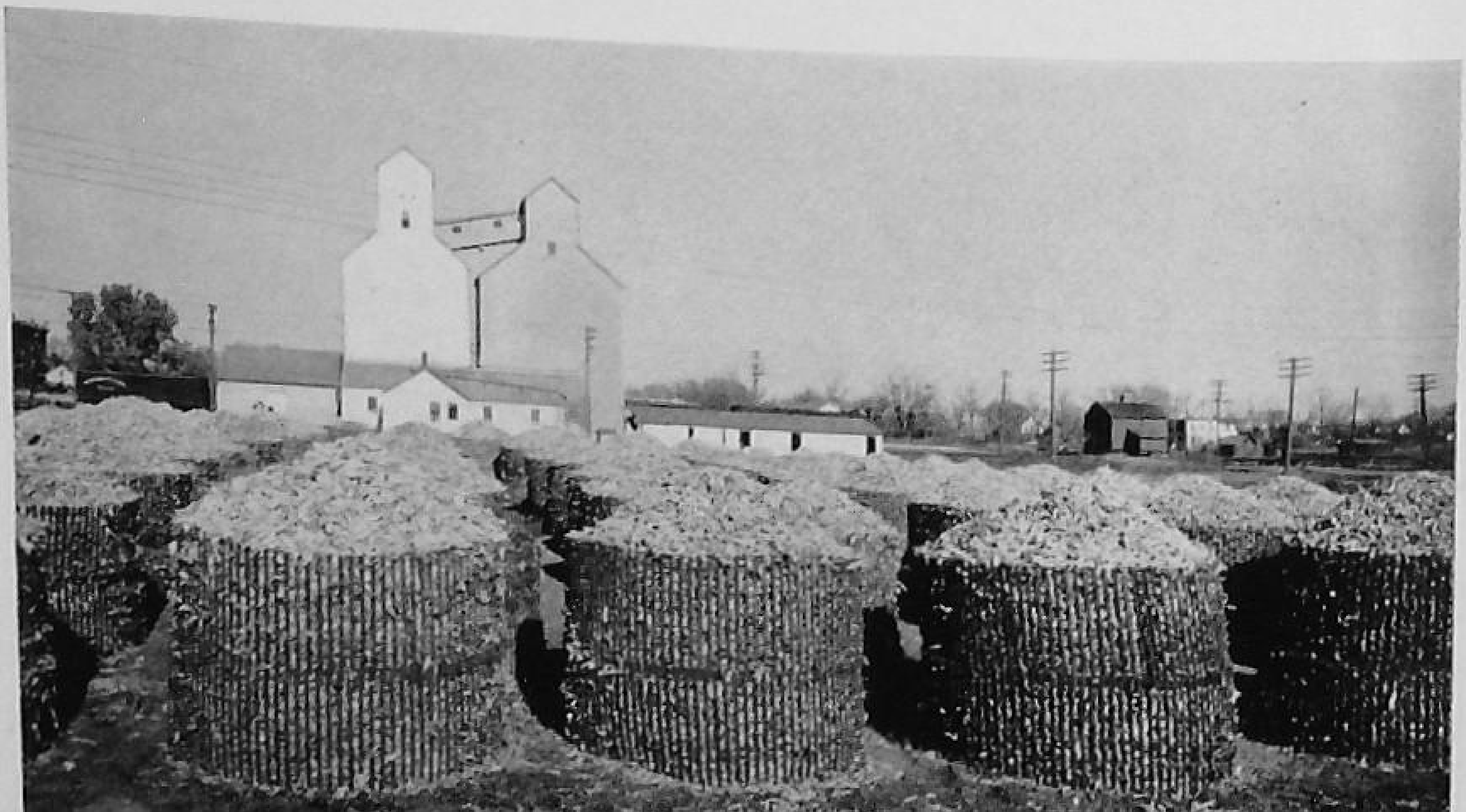

PLATE VIII. TEMPORARY STORAGE FOR CORN

Through the development of adapted varieties, corn steadily encroaches upon the wheat land. Because the area in which corn can be grown is climatically more limited, corn out-competes wheat for use of the land.

tary areas in Montana and Minnesota. Still another is the northwestern Idaho and eastern Washington wheat region. Elsewhere, wheat production falls into a minor part in crop combinations for a more general type of farming.

Two classes of wheat are grown: the so-called winter wheats, of which there are three groups; the hard red winter wheat, as grown on the western plains; the soft red winter wheat, as grown in the corn and wheat region and in the eastern states; and the soft white winter wheats, as grown in the northwestern Pacific region. These groups take the name of winter wheats, for the reason that the seed is sown in the fall and the crop harvested the next summer. In growing the spring-wheat classes, the seed is sown in the early spring and harvested late in the same summer. The farm organization is much the same for each class of wheat, though somewhat different cultural practices are involved.

Wheat raising is an industry that requires large areas of land. While many small farms are found in the wheat regions, the most common size ranges between 240 and 480 acres. Many farms in the more intensive wheat-growing areas may, however, contain 2,000 acres or more. In both the winter and spring-wheat regions, wheat growing is highly mechanized and, where conducted on a large scale, calls for a considerable investment in horses or tractors, tillage implements, and combines for harvesting purposes. Considering the number of acres involved and the machinery employed, the total capital requirements are great, though the capitalization per acre is not so much as in truck farming and fruit farming. The level to rolling prairies and the tablelands of the Great Plains are well suited to the use of large-scale machinery and it is there that wheat farming is most effectively conducted. Wheat growing is a seasonal occupation, calling for intensive activity during the spring seeding season and the harvesting and threshing seasons. It gives little employment during the winter season, and, therefore, does not make a well-rounded business. It is for this reason that wheat farmers often include some other crop in their crop combinations and keep some form of livestock to give winter employment for the family of the operator and for at least some of the employees needed during the active season.

The durability of the wheat product in the form of grain makes it unnecessary that wheat be raised near population centers. Wheat can be stored for long periods when well matured and dried and can be shipped long distances. There is always a

market for wheat at some price. Its value is high enough, ordinarily, to demand good prices on the world markets. Its value is as great at distant shipping points as at the metropolitan centers, with a differential allowed for transportation expense.

CASH-GRAIN FARMING. Throughout the Corn-Belt states of Ohio, Indiana, Illinois, and Iowa, and in the spring and hard winter-wheat areas, are many farms that derive the larger part

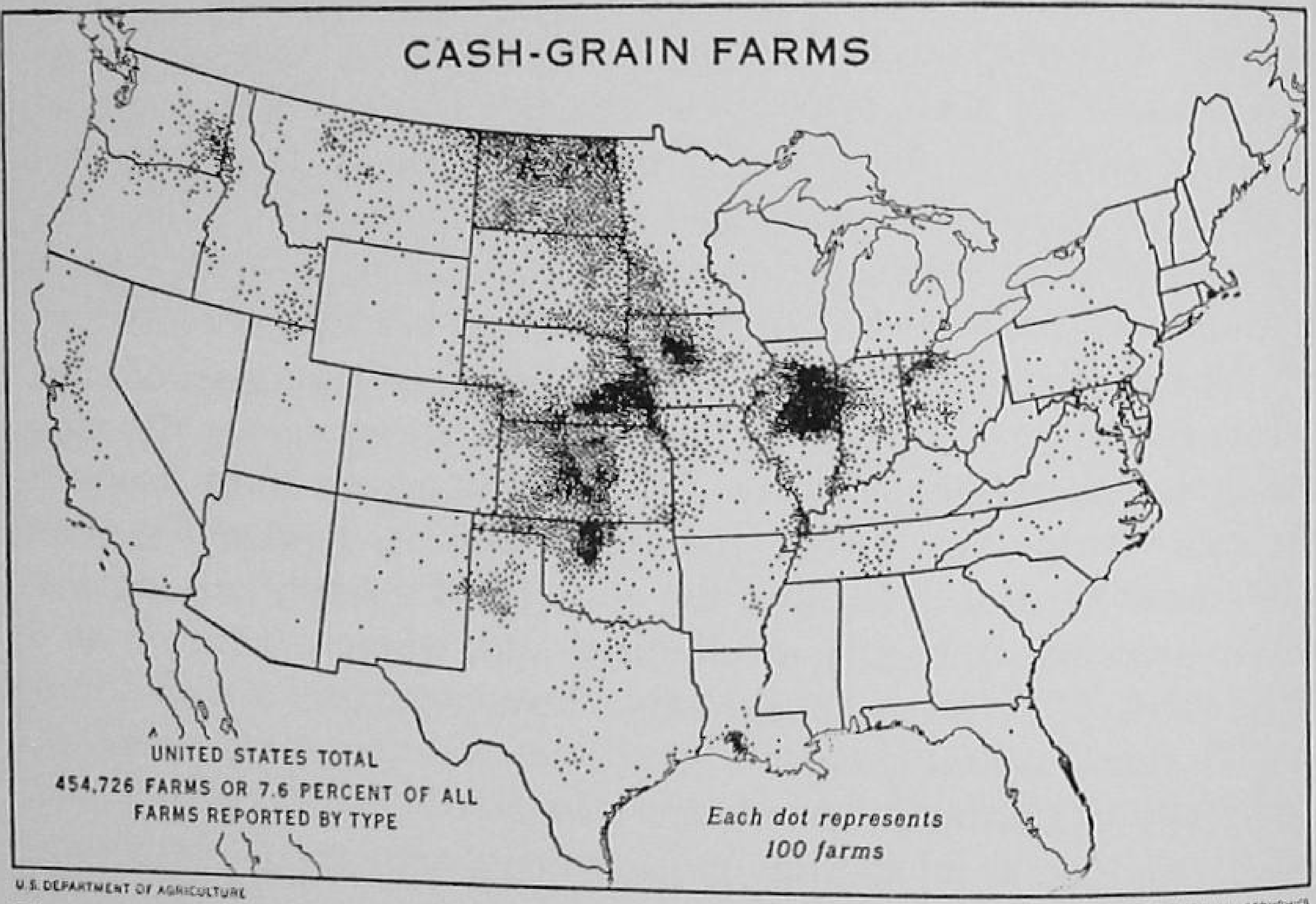

Figure 9. Cash-grain farms are largely commercial farms. On many of these wheat is one of the most important crops. Barley, oats, flax, and rye are also grown in large quantities in favorable areas. The highest concentration of cash-grain farms is found in the North Central group of states.

of the gross income from the sale of grain other than wheat alone. The kinds of grain vary widely within the area. In parts of Illinois and Iowa, corn and oats are the principal grains sold for cash. In Kansas, Oklahoma, and Texas, winter wheat and grain sorghums are the chief sale grains. In the Dakotas, spring wheat, rye, flax, barley, and oats are more commonly produced. In all this territory many different combinations of these crops will be found within the same area and even on adjoining farms. This fact is interpreted to mean that all the cereals are equally well adapted and that none possesses outstanding economic advantages over the others. Farmers are, therefore, able to choose those crops or combinations of crops which best fit the physical and economic conditions surrounding the individual farm.

Labor and capital requirements and operating equipment are much the same for all the cereal crops. Corn, however, being an intertilled crop, requires some specialized machinery not adaptable to the other crops mentioned.

COTTON FARMING. Cotton farming is rigidly limited by climatic conditions. Very little cotton is grown outside what has been designated as the "Cotton Belt." Small quantities are grown

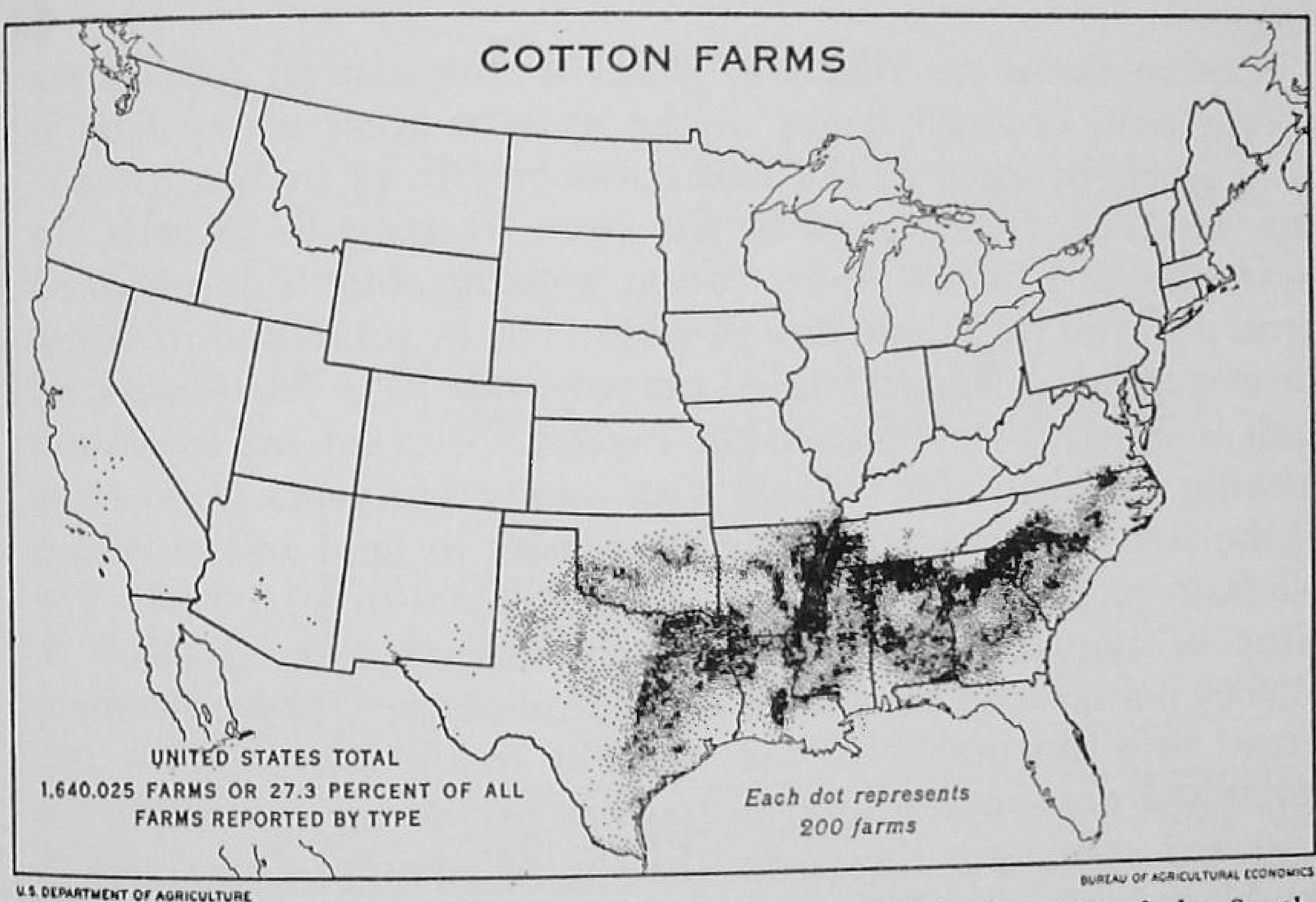

Figure 10. Cotton farms are most numerous in areas of fertile soils of the South in part because their limitation on acreage of cotton is the quantity that can be picked by the family before winter. The district of greatest density of farms contains many plantations.

in some of the irrigated valleys of the Southwest, but the main crop of cotton is confined to the Cotton Belt. The first essential of growing cotton is that there be a growing season of 200 or more frost-free days, with high summer temperatures prevailing. During the months of June, July, and August, temperatures should not fall below 70 degrees F. A second essential is abundant, but not excessive, moisture. Rainfall at the western limit of the Cotton Belt is about 20 to 25 inches, which is barely enough for producing satisfactory crops. At the southeastern border of the Cotton Belt, rainfall reaches 60 inches, which is above the requirement best for the cotton crop. More than 60 inches of rainfall causes excessive vegetative growth and results in small crops of cotton lint. Those areas having an annual rainfall of 30 to 40

inches and where summer temperatures run 70 to 90 degrees F. are most favorable for cotton farming. One wishing to operate a cotton farm must go to the Cotton Belt.

Cotton grows best on the medium grades of clay loam soils, provided they are well drained. Rich clay soils are likely to produce too much vegetative growth, particularly where the rainfall is heavy. The upland sandy soils are handicapped by low natural fertility, and, unless they are heavily fertilized, the yield will be poor.

Cotton farms are relatively small in the eastern part of the Cotton Belt, but run larger in the western areas where land is more level. In some of the best cotton territory in South Carolina, farms in 1929 ranged in size from 51 acres to 78 acres. In areas especially favorable for cotton growing, highly mechanized farms may run into thousands of acres. Of the total land in farms, the average crop land harvested ranged from 26 to 35. Since land itself is relatively low priced, the capital requirements for cotton growing are small as compared with most other types of farming. In the area just referred to, the investment in land and buildings per farm ranged from an average of $1,873.00 to $2,617.00. The value of implements and machinery ranged from $105.00 to $136.00 per farm. These farms are typical of the Old South where Negro help did nearly all the work by hand, using one or two mules and the simplest kind of tools in preparing and tilling the land and caring for the crops. In the Mississippi Delta and in the black land belt of Texas, the farms are much larger and the capital investment runs much higher. In recent years, machine pickers have been developed which, on the large farms, are taking the place of hand picking.

But little livestock is kept on the small cotton farms. In many instances, it is limited to one mule, a brood sow, and a few hens. The more enterprising farmers, with larger farms and where capital resources permit, keep sufficient livestock to supply the family and farm help with meat and milk.

The labor requirements for cotton growing are seasonal as on most special crop farms. Horse or mule labor is in greatest demand during the early season when the land is being prepared, and in the cultivating season. Man labor also is heavily used at this season and in chopping and hoeing time. Perhaps the most active demand for man labor is at picking and marketing time. Other crop enterprises should be combined with the cotton crop on the well-managed farms in order that labor may be more fully

employed. On the best-managed farms, some livestock is kept for the double purpose of giving full-time employment to labor and of adding to the income of the farm.

Crop-Specialty Farming. Scattered widely over the United States are many farms organized for the production of some special crop or crop product. Under this term are included farms

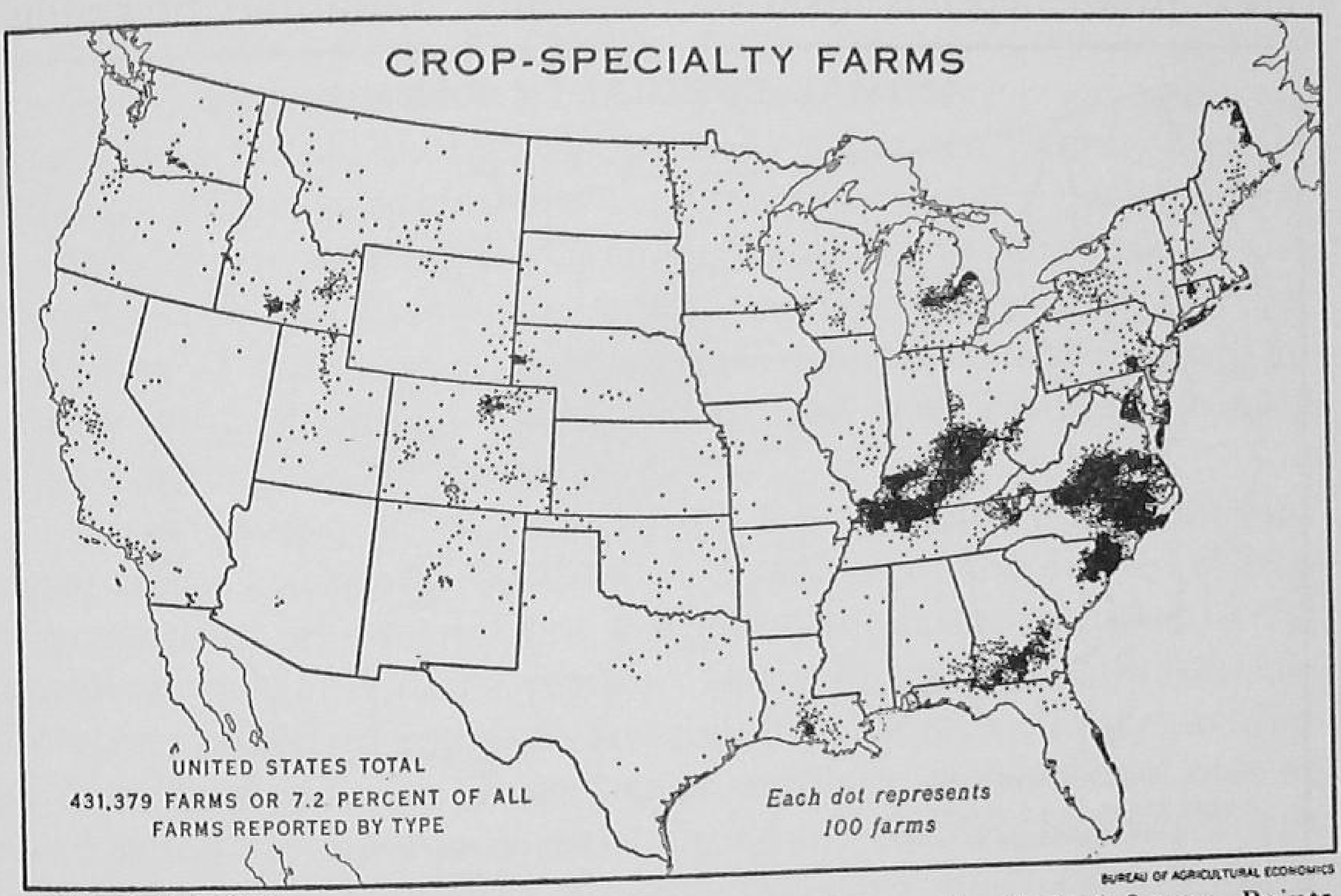

Figure 11. Crop-specialty farms are widely spread over the United States. Points of highest concentration are found in the tobacco lands of Kentucky, Virginia and North Carolina. Concentration of potatoes in northeastern Maine and central Michigan and in Idaho will be noted. Production of sugar beets and potatoes in less dense numbers will be found in the Red River Valley, in Colorado, and in California.

that grow primarily such crops as tobacco, potatoes, sugar beets, sugar cane, dry beans, and other highly specialized crops. Tobacco farms are highly concentrated in Kentucky, North and South Carolina, southern Virginia, the Connecticut River Valley in Massachusetts and Connecticut. These are small farms that require much hand labor. The potato farms are found scattered over the New England states, New York, Wisconsin, Minnesota, North Dakota, and in irrigated valleys of the mountain regions. Sugar beets, potatoes, and dry beans dominate the cropping program of the crop-specialty farms in the far West. Climate is the most important factor in the location of this type of farm, though soil quality is also an important influence. Each crop requires special machinery and equipment and varying expenditure of

labor. On account of the variety of the factors involved, it is not possible to describe in general terms the organization of crop-specialty farms.

General Livestock Farming. In many parts of the United States and particularly in the Corn Belt, conditions are favorable for the growth of almost all kinds of livestock. The kind of livestock grown depends upon the economic conditions prevailing,

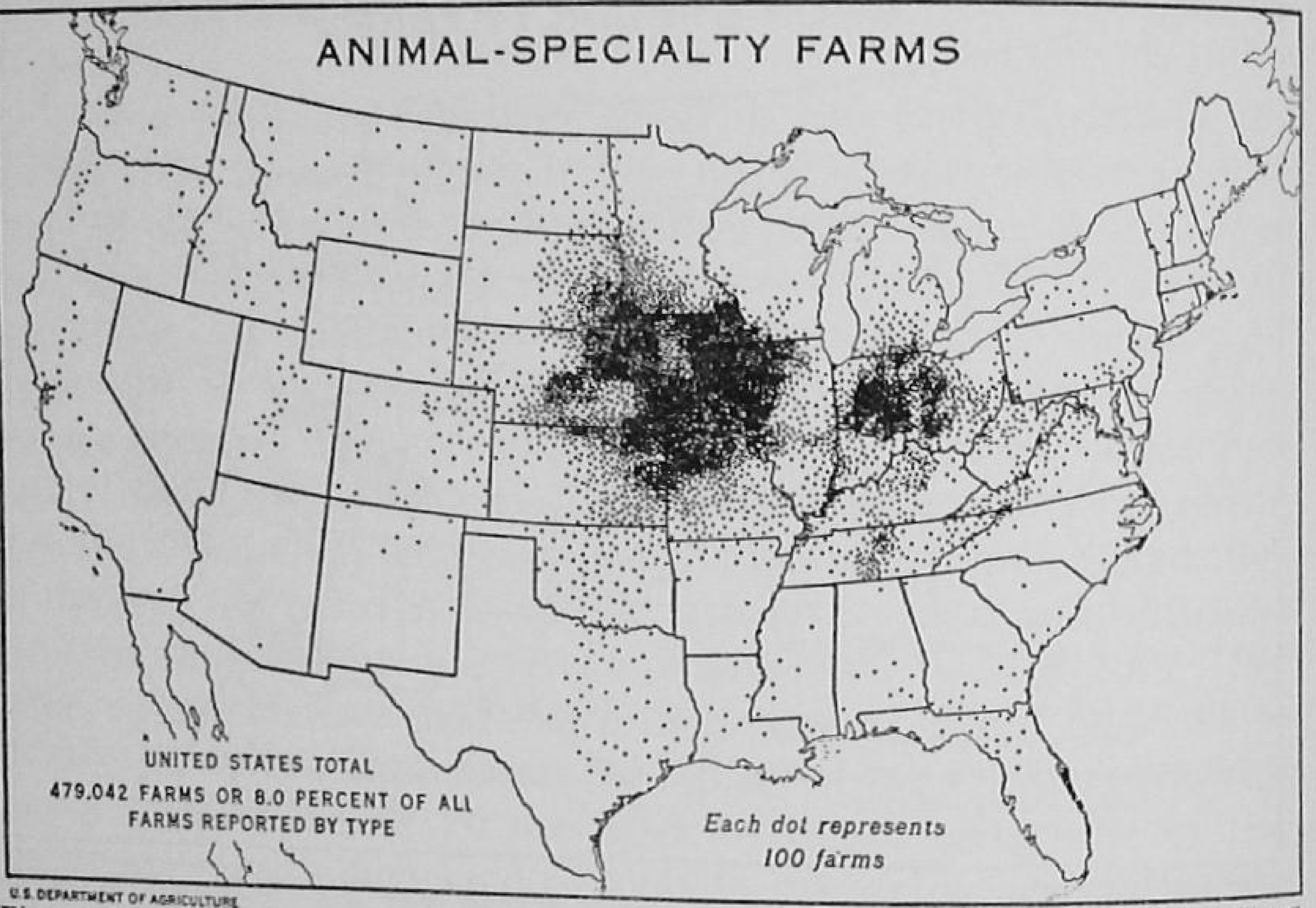

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Figure 12. Animal-specialty farms are highly concentrated in the Corn Belt. On these farms a combination of livestock enterprises is usually found. Beef production, or swine production, may be the major line, but these will be supported with sheep in some instances and with poultry in nearly all instances. The livestock on these farms is used mainly as a medium for converting into market products the corn and other coarse feed crops so liberally produced.

the supply of family labor available, and the choice of the operator. A combination of beef cattle and swine is very common. Many farmers raise horses, beef cattle, swine, sheep, and, sometimes, poultry. Those inclined to dairying usually combine swine and poultry with the enterprise and in some sections sheep, as well. In any region where conditions are favorable for either beef cattle raising or dairy farming, swine, sheep, and poultry may well be included if the resources of the farm and the skill of the farmer warrant so wide a field of operation. On many of these combination farms less than 40 per cent of the income may be from any one class of livestock or crop. That fact would throw them in the class of general farms instead of livestock farms.

Throughout much of the Corn Belt, beef cattle, hogs, and poultry constitute the chief sources of income. These farms are known as animal-specialty farms. The physical and economic environment favorable to these is the same as for beef-cattle raising or for dairying. No attempt, therefore, is made to discuss them separately. On many of the animal-specialty farms winter feeding of cattle is a chief enterprise. These cattle may be bought at near-by stockyards or shipped from the plains where winter feeding is seldom undertaken. Very few farms operate as purely hog-raising farms, though occasionally some are found. Usually swine raising is supplementary to either dairying or cattle raising. In the eastern part of the Corn Belt and the western part of the Middle Atlantic states, the animal-specialty farms may take on the form of sheep raising only. Such operations are confined to only a few farms, however, as poultry and dairy cattle are usually found in the farm organization.

Dairy Farming. While dairying is a widespread industry and dairy farms are found in almost all regions of the United States, it assumes major proportions mainly on the farms included in the northern hay and dairy region. Dairy farming is most successfully conducted in a temperate climate. In such climates as that of New England, the Great Lakes region, and the West Coast of the United States, it is at its best. It succeeds best in areas where precipitation is abundant, though excessive moisture is a detriment. Dairying is difficult in a tropical climate for the reasons that heat affects the animals, it is difficult to grow suitable forage, and disease-carrying insects endanger the health of the animals. In such climates, it is difficult to keep in good condition either the milk or the butterfat, in which form the product is usually marketed.

The ease with which grass pastures, hay, and roughage can be produced makes the northern hay and dairy region especially adapted to dairying. Good grazing land is one of the first essentials in successful dairying. That is where the hay and pasture region excels. Less labor is required to care for the animals when on pasture than at any other time, and good pasture forms the cheapest kind of feed for dairy cattle. The outdoor life on pastures also promotes the health and nutrition of the animals, resulting in high production during the pasture season. Sufficient precipitation to insure green pastures throughout the summer is a requisite. The humid climate is favorable to the comfort of the animals also, again stimulating production.

Nutritious and palatable cured forage must be provided for winter feeding. Succulent feeds are a factor in securing high production. Root crops, silage, and well-cured leguminous forage crops are particularly desirable. These, with the good grazing lands, furnish the foundation for economical dairy production. For the best results, grain concentrates also are required. These, however, can often be purchased more cheaply in the grain-grow-

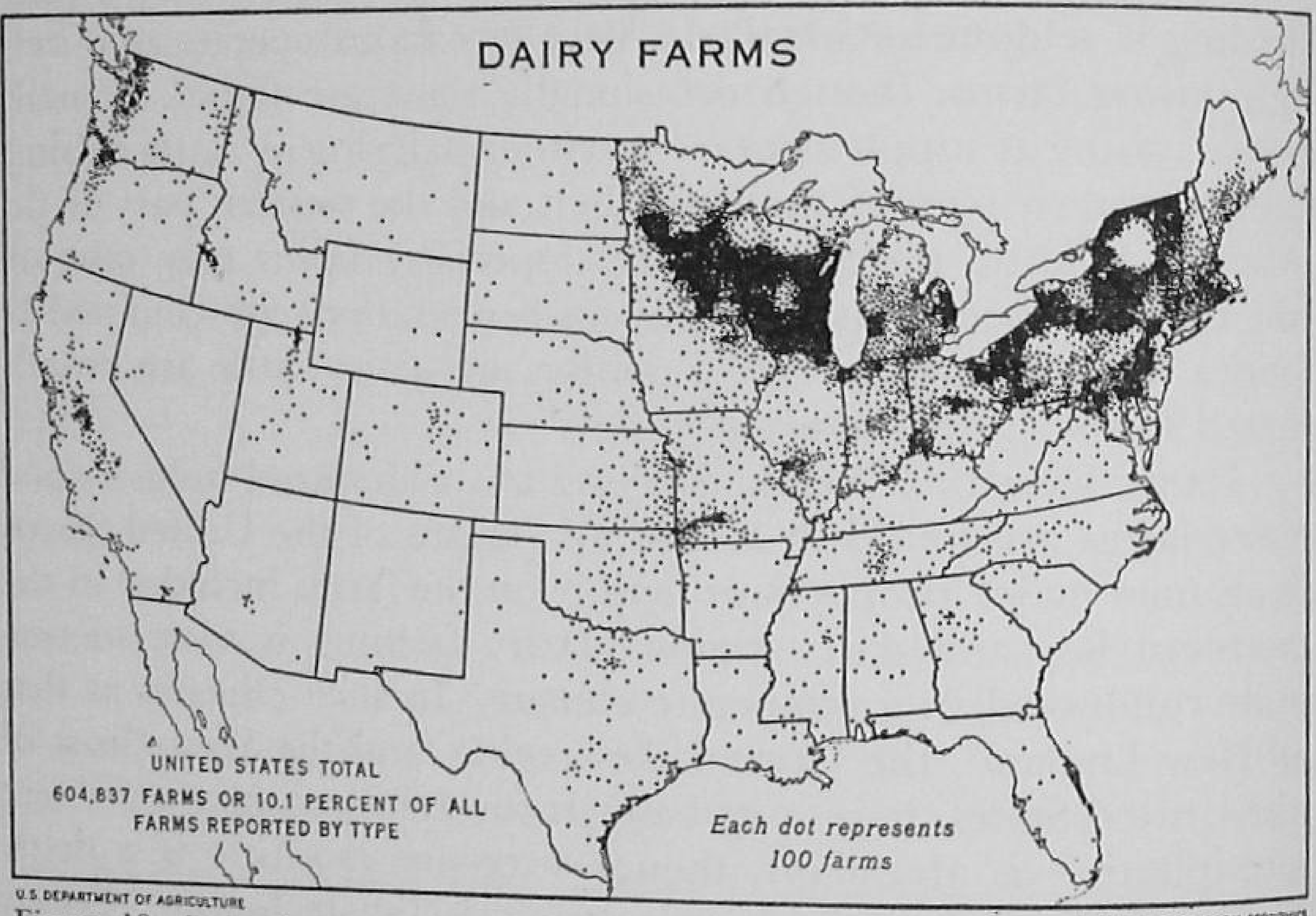

Figure 13. Dairy farms are largely confined to the hay and pasture region of the northern and eastern part of the United States. While some dairy farms are scattered throughout the South and to the westward, they are very limited in the Great Plains areas and in the southwestern mountain areas.

ing areas than they can be produced on dairy farms. The major portion of the feed supplies on the dairy farm should be in the form of pasture grasses, well-cured dry forages, and succulent roughages, such as silage and roots. These can all be provided in excellent form throughout the hay and dairy region. They can be provided also on farms in some of the other regions and dairying can be successfully conducted outside the area designated as the hay and dairy region. The natural and economic advantages of this region for dairying outweigh those of any other similar region in the United States.

Good soil is a distinct asset on a dairy farm as it is on any farm. The quality of land and topography, however, are not so essential in dairy farming as in many other types. Pasture land may be rolling or quite rough. Even if kept continually in grass,

erosion will occur. A poor soil can be improved by the application of barnyard manures and artificial fertilizers, but such a soil is more expensive to maintain than a naturally fertile one. It is essential that the mineral elements, calcium, phosphorus, and potassium be present in the soil else serious deficiencies in the forages will result in malnutrition of the animals and low production.

Labor requirements on a dairy farm are exacting and continuous. The presence of an attendant is always required at milking time, which is twice a day on well-managed dairy farms, and three times a day on some of the best. The milking must be done seven days in the week and the job lasts the year around. Labor must be skilled for the best results. Experienced milkers and caretakers are essential if good performance on the part of the animals is to be attained. The manual labor calls for dexterity, and successful operation calls for skilled management of labor and animals. The labor requirements are large as compared with those on other types of farms. One hundred twenty to one hundred eighty hours are required annually to care for each cow. Large herds are maintained more economically, so far as labor is concerned, than small herds, but it is not possible to perform the milking required and give the feed and care necessary much short of the hours stated. On many farms where dairying is a minor enterprise, family labor, including that of growing boys and girls, usually is employed to do the milking. On highly specialized dairy farms where milking machines are used, it is highly important that competent operators do the milking and that it be done rapidly and skillfully. Recent investigations indicate the importance of regularity, promptness and thoroughness for inducing the cow to "give down" a full flow of milk and in preserving a healthy condition of the mammary glands. Mechanical equipment in the form of milking machines, cream separators, aerators, and the like, reduces manual labor to some extent but increases the capital outlay.

Dairy farms are small as compared to those raising beef cattle or those engaged in cash-grain production. Eighty to 160 acres is required for an economically operated family dairy farm. Commercial dairy farms may run much larger in size. In the best part of the dairy region, family farms may run to 240 or even 320 acres in size. At the western and southwestern edge of the hay and dairy region adjacent to the Corn Belt, hog raising is usually combined with dairying. The hogs utilize the dairy by-

products to excellent advantage. Poultry and cash crops are also included in the organization of many dairy farms.

The capital requirements for the dairy farm are somewhat greater than for grain farms or for beef-cattle raising. While the land may be cheap in some areas where dairying is adapted, in other places land values run high because of the quality of the soil and because of competition of other enterprises. Winters are cold and long in the dairy region, requiring that the animals be housed. The expense for barns, outbuildings, and equipment for handling the dairy cows is large. Feeds and labor must be provided in quantity and, if purchased, increase the capital requirements for dairy farming.

Dairy products from dairy farms are marketed in various forms. Near the great metropolitan centers of the East and adjoining the Great Lakes, the product is marketed largely in the form of fluid milk. This work requires daily delivery to collecting centers, pasteurizing in some instances, and refrigeration to keep the product in good condition until delivered to the retailer. In areas more remote from the metropolitan centers, the product is usually marketed as cream, butterfat, or, in the most remote areas, as butter. In the best of these remote areas, co-operative creameries have been organized which take the fluid milk or cream from the dairy farm and manufacture butter and powdered milk for shipment to the market. In the form of butter, it possesses high specific value and can, under refrigeration, be preserved for some time. It can be shipped, therefore, long distances to favorable market outlets.

BEEF-CATTLE RAISING. Beef cattle are adapted to a wide range of climatic conditions. They do best, however, in a temperate climate free from great extremes of heat and cold. In tropical climates insect pests and contagious diseases often cause severe losses and difficulty is experienced in providing satisfactory feeds and forages. In frigid climates the grazing season is short and grains and forages are not grown in sufficient quantity to support the herds. Moisture must be sufficiently abundant to stimulate the growth of suitable grass and forage crops and to provide good drinking water for the animals. Cattle can be kept on large areas of arid land provided water can be supplied at convenient points from springs, wells, or other sources.

A first essential for beef-cattle raising is ample grazing land with water rights and supplies. Good pastures furnish the cheapest feed and reduce the labor costs of caring for the animals. Out-

door life on good pastures promotes the health of the animals and reduces loss from diseases. There must, therefore, be large areas of good grass land on a beef-cattle farm and some land suitable for the production of winter feed for at least the foundation breeding herd, which must be carried over. Where cattle are fattened for the market it is an advantage to be located close to areas where low-priced grains or grain by-products can be obtained for fattening those that are to be sold.

The labor requirements on a beef-cattle farm are not so exacting as on a dairy farm. Skill and knowledge in feeding and management are essential for the best results, but throughout the grazing season little manual labor is required in caring for the herd. Not more than 8 or 10 hours of labor per head per year will be required under good management, whereas 120 to 180 hours per head are required in caring for a herd of dairy cows.

Topography and soil character are less important in beef raising than in operating the more intensive types of farms such as truck or dairy. Good quality soil is an advantage, however, as it gives assurance of larger feed supplies at less cost. Rolling or hilly land is no great disadvantage and sometimes gives a desirable variety in forage growth and in physical conditions. High, rolling, and well-drained lands yield sweeter, more nourishing grasses than wet, sour lands, and with more healthful environment.

Beef raising, being less intensive than dairying, will be crowded farther away from the good land and will be practiced in areas distant from large population centers. This tendency is in accordance with Von Thuenen's law, described on pages 74 and 75.

Beef cattle are successfully raised in nearly all parts of the United States. Beef-cattle farms, however, are of two types and found in the largest numbers in the Corn Belt and the Great Plains. These types are (1) animal-specialty farms, found chiefly in the Corn Belt, comprising Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, Nebraska, South Dakota, and Minnesota; and (2) livestock ranches, found principally in the grazing and irrigated crops region, covering most of the western half of the United States.

On the animal-specialty farms of the Corn Belt, but few farms are devoted exclusively to beef cattle. The usual combination is beef cattle with hogs or with hogs and sheep. The cattle and sheep make use of the grass, rough forage, and hay crops and convert them into meat products and the hogs consume a larger

proportion of the corn grain. On many animal-specialty farms, hog production may at times be of greater importance than beef-cattle production. Corn is the principal grain crop on these farms and is used both for finishing the beef cattle for market and for hog feeding. Here the farms vary in size considerably, but range in most states from 100 to 500 acres in size. The most commonly prevailing size is 175 to 260 acres. Capital requirements run high because of the relatively high value of land in the Corn-Belt area and because of the investment necessary for breeding stock and for equipment for operating the farm. On many of these farms where large crops of corn are raised the operators buy calves or yearlings from the western ranges or from the stockyards to grow out or to finish for the market. In this way they dispose of the corn crop and provide a means of maintaining the productive power of their farms by the application of animal manures. Winter feeding at the same time gives employment to farm labor that may not otherwise be fully employed, and is a large factor in profitable farm operation.

Livestock ranching is an altogether different type of farming from animal-specialty farming. Here the ranches are devoted almost exclusively to one kind of livestock and but little land is put into crop. On most of the ranches some hay is cut for winter feeding, but little or no grain is raised as little winter feeding is done. Either the cattle are finished on grass and cottonseed meal or other purchased concentrate, or they are sold and shipped to Corn-Belt feeders who fatten them for the market. On some of the southern ranches, kafir corns and sorghum grains are grown for winter feeding and the practice of finishing the cattle on the ranches is increasing. Ranches run much larger in size than the animal-specialty farms. So-called family-sized ranches in the Southwest range from 2,000 to 40,000 acres, or more. The average size is 12,000 to 15,000 acres. Another way of stating the size is in the number of cows kept. It is estimated that 400 to 600 mother cows are required to support an average ranch family. Since 10 to 40 acres per cow, depending on the quality of the range cover, is required for full-year grazing, a ranch should contain from 4,000 to 24,000 acres, as indicated by the size of the herd and the quality of the range. Ranges in the Northwest will run smaller in size than in the Southwest, as the grass usually is of better quality. Winter forage is an essential factor of safety in carrying the herd through the winter when deep snow or severe blizzards may prevent feeding on the range lands.

The capital requirements for the establishment of a cattle ranch are high, particularly if operated under the land-ownership system. While ranch lands are usually of low quality and value, the land required for a family-sized ranch runs into thousands of acres. The large number of breeding stock that must be maintained also calls for a heavy investment. Land and cattle are the chief items of investment, however, as buildings and

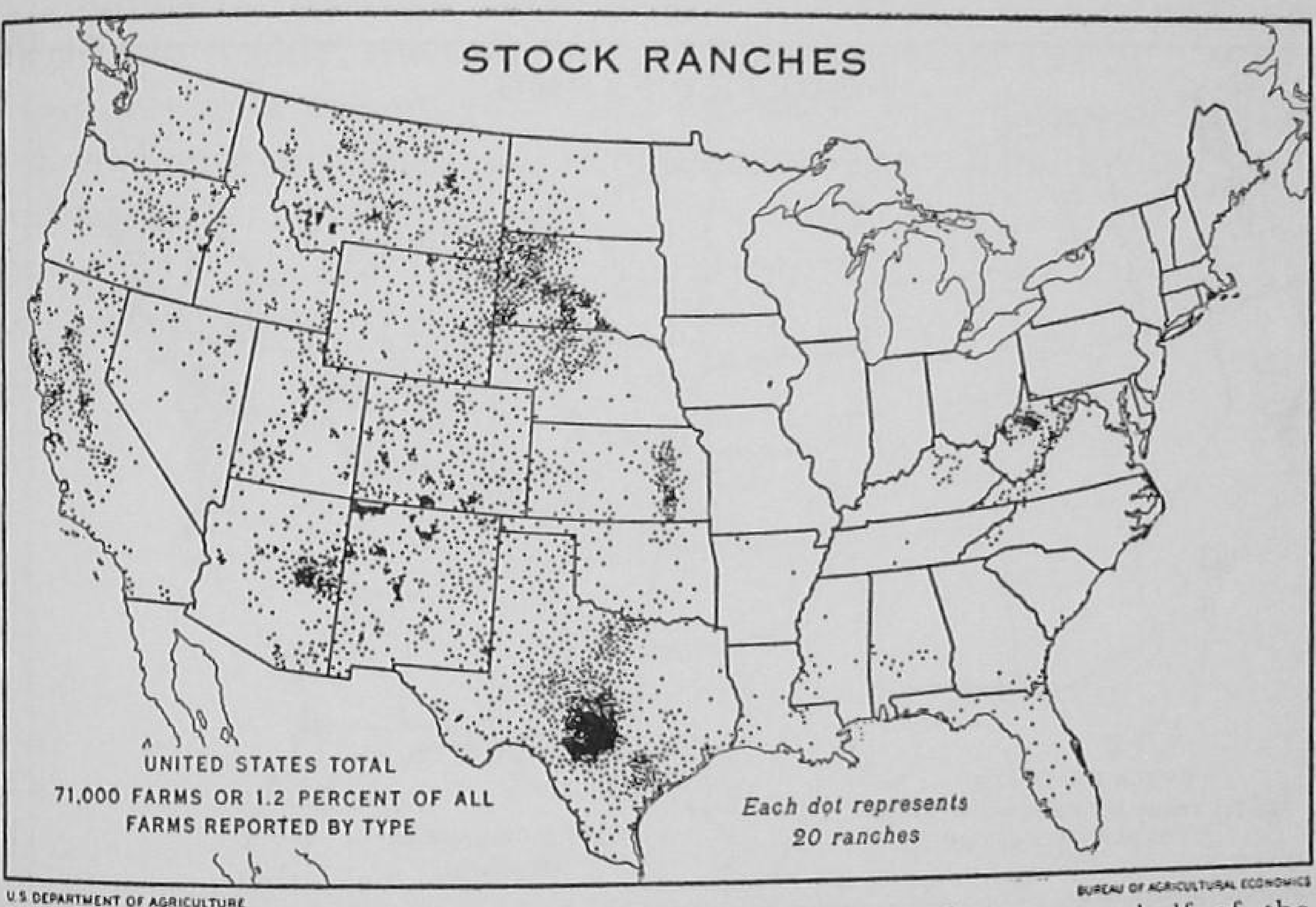

Figure 14. The livestock ranches are found largely in the western half of the United States. The highest concentration of such ranches is found on the short-grass plains scattered from Montana and southwestern North Dakota on the north to Texas on the south.

equipment are but little used. In many instances small parcels of land are purchased with water rights strategically located and arrangements are made with state or federal authorities for the use of additional land under lease contracts. In most instances the investment in land is about equal to the investment in the productive livestock.

Poultry Farming. Nearly every American farm of whatever type includes chickens or other poultry in the organization plan. This inclusion is made because poultry on the average farm is kept at small expense. Chickens, particularly, that range over the farmstead and barnyards, pick up most of the food required from materials that would otherwise go to waste. They are cared for by the farm family at little labor cost and return to the family both eggs and meat of considerable value in the family food

budget. It is probable that half or more of the poultry and poultry products of the United States come from the flocks kept as minor enterprises on the family-sized farms of all types.

There are highly specialized poultry farms, however, where poultry or poultry products form the chief source of income. In the main, these appear to have a close relationship to the large city markets. The highest concentration is found in the Atlantic

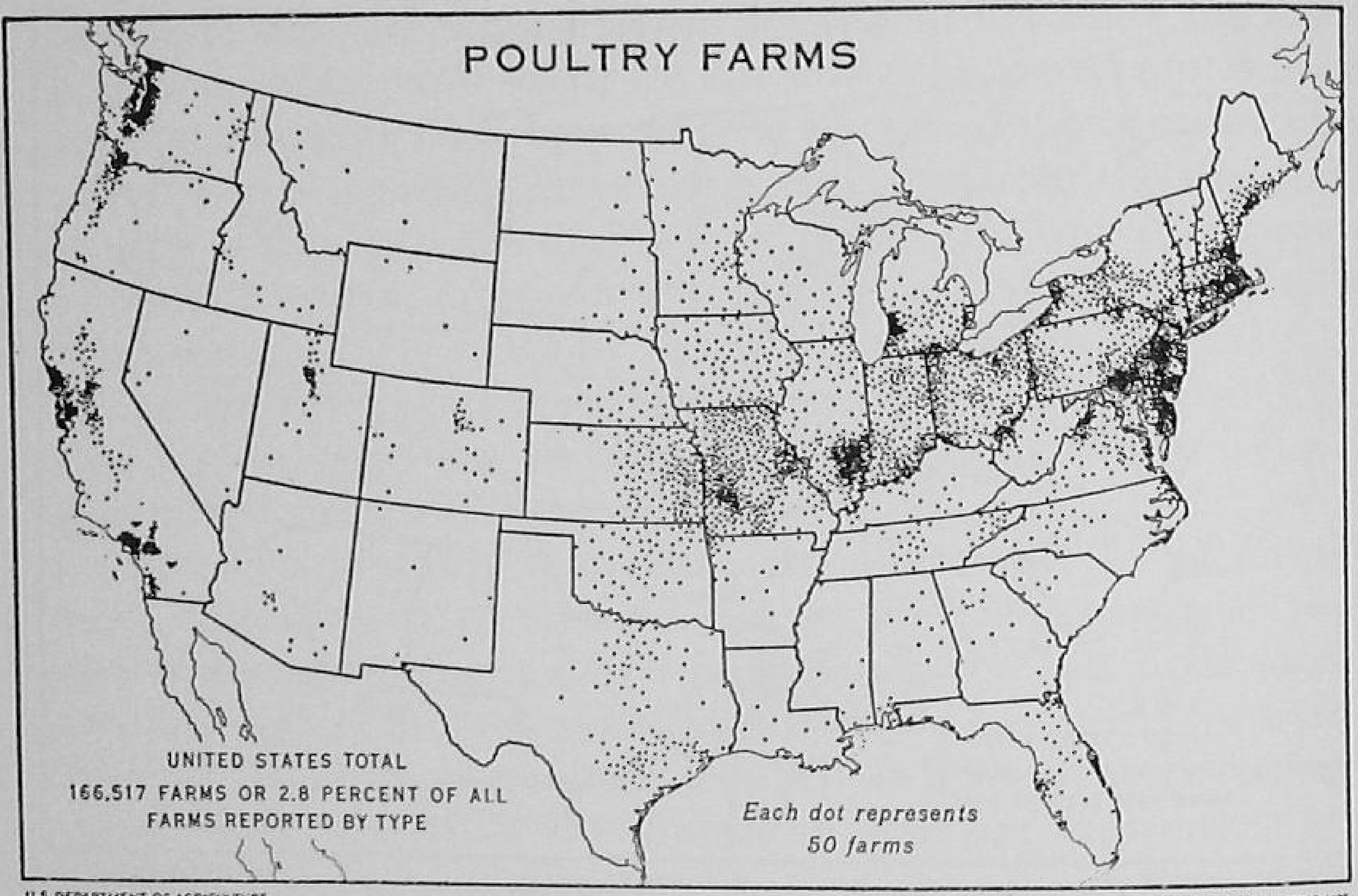

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Figure 15. Poultry farms follow closely upon industrialization. The greatest concentration is found along the Atlantic seacoast in the densely populated areas, extending westward through the industrial centers and along good transportation routes.

Coast states near the industrial and commercial centers. There is high concentration also in the eastern Corn-Belt area bordering the Great Lakes industrial centers and in the Pacific Coast states, which are primarily egg-producing areas. Chickens are by far the most common type of poultry raised, though the production of ducklings for a special trade is of importance in the East and turkey raising in the Central states and Southwest is increasing rapidly.

Poultry farms are relatively small, ranging from 10 to 20 acres to 60 or 80. The smaller farms are found in the East and on the West Coast. Poultry farms in the Corn Belt run somewhat larger, but are not so intensely specialized. Good housing and sanitary surroundings are the first essentials of a poultry farm.

There should be land enough, so that young poults may be provided with clean runs. If kept continuously in the same runs or yards, the soil becomes infested with parasites, which become a source of diseases which endanger the health of the flocks. But few poultry farms attempt to raise feed for the flocks. Grain and prepared feeds are purchased in quantities needed. Constant care in providing the right kind of ration for egg or meat making is required. Skill in buying and selling and in managing the flocks is highly essential in profitable poultry raising. Capital requirements are smaller than for many other types of farming. The chief expenditures will be for land, buildings, poultry stock, and feed.

Chapter VIII

BECOMING ESTABLISHED IN FARMING

To become well established in a good farm business requires much thought, objective planning, and careful and well-timed investments. Only those possessing considerable free capital can buy outright a well-organized, fully-equipped farm, ready for immediate operation. Most young men who wish to enter the vocation of farming will have to begin, in a modest way, to build themselves into the ownership of a farm, wherever they can find what appears to be an attractive opportunity. This effort may extend over a period of years. The accumulation of property or additional capital year by year, however, is a stimulating experience and will lead eventually, if pursued, to the desired objective. Experience has shown that the farmers most likely to succeed are those who begin in a small way, learn by practice, and slowly accumulate property by their own effort and management. In this way costly mistakes may be avoided.

There are various ways in which young men can start toward farm ownership. The following are suggestive:

1. Many start by undertaking a project on the home farm, working in co-operation with their parents. Savings accumulated may become the source of later property ownership.

2. Others may work out a partnership agreement in which they, with their parents, operate the home farm on some specific plan under which the income is divided equitably in proportion to the contribution made by each toward its operation.

3. Still others may undertake to rent the home or other farm fully equipped, where only the man labor and management are furnished by the operator.

4. Those having nothing with which to start and unable to work into one of the plans suggested may have to start as farm hands and from their earnings save funds with which to buy sufficient power and equipment to operate a farm on a rental contract, and eventually buy as capital is accumulated.

5. There is also in some cases the possibility of acquiring a farm by inheritance or by partial inheritance. In instances where there is only one child in the family this method is a natural

and logical step. Where there are two, three, or more children, it may involve the problem of buying out other heirs, in which case unsatisfactory family relationships sometimes arise. That a better understanding of the possibilities under these plans may be given, a more complete discussion of each plan follows.

A HOME PROJECT PARTNERSHIP

On many, but not all, farms it is often possible to set up a crop or livestock project for which one or more of the children of the family take the financial and management responsibility. Many examples of such projects are found in the records of 4-H Club members, Future Farmers of America, and others engaged in organized agricultural activities. Under such arrangement the junior member usually acquires through gift or purchase, sometimes on borrowed money, the ownership of one or more animals, a flock of turkeys, chickens, or other poultry. By specific agreement he is allowed building and yard space as needed, and either land for producing needed feeds or the privilege of feeding from farm-grown supplies. If feeds or supplies that are not produced on the farm are needed, the project operator should be enabled to make necessary purchases to be paid for out of earnings. In cases where the nature of the farm business does not lend itself to livestock production, a project may be set up covering some crop or product lying within the usual farm activities. A few acres for the production of a good market crop, a good-sized plot of potatoes, popcorn, or beans is suggested as suitable bases for project work on many farms.

The objective of such projects is to develop initiative, resourcefulness, and good judgment on the part of the young operator. There should be, at the same time, a fair prospect for financial gain under good management. In all cases the operator should keep a complete record of all expense and income, and show the profit or loss from the undertaking. Needless to say, the proceeds from operation should go to the project worker as a start toward property ownership.

TAKING MANAGEMENT RESPONSIBILITY

Another form of activity which does not involve ownership contemplates taking over the care and management of some specified crop or a group of animals. As a reward for participation in the work of the whole farm and for the labor and management expended on the special enterprise, the project operator

receives a reasonable percentage of the sales income from it. An illustration of this type of project will show the possibility for earnings from such a source.

On a farm where 20 brood sows were normally kept, a late "teen age" son was offered a 20% share in the sales from the hogs if he would take over their care and management. In addition, he was to assist with all other farm work as time and strength permitted. The normal marketings from this farm annually were 110-225-pound hogs, a total of 24,750 pounds. At 6c per pound the income from the hogs would be $1,485.00. Twenty per cent of this amount is $297.00. This sum was practically the equivalent of $25.00 a month for the year in addition to room and board, which is more than was being paid for hired hands at the time.

One must keep in mind the fact that the income of the owner of the farm was reduced by this amount. The reduction is only a little more, however, than would have been required to pay a hired hand outside the family. The son was at the same time developing initiative and learning to take responsibility, which abilities are valuable assets for later operations. One should understand also that, where there are several children in the family, the average farm could not afford projects for each with such generous participation in the farm income.

There are too many variations in the types of project that may be undertaken to permit full description here. Each farm and each farm family offers its own problems and solutions. It is not uncommon to find a son receiving 10% or 15% of the total farm income in lieu of total income from a definite project as a reward for his year of service. Cases are on record where a 15% share of the income from a 160-acre farm added $475.00 to the net worth of one youth and $338.00 to the net worth of another. Still another who received 15% of the gross income, but who paid 15% of the expense for mill feed and hired labor, gained in the year $463.00. In some cases the project operator may receive a specified proportion of the income from the dairy herd or from beef and hog sales. In other cases he may get the income from a specified number of sows and litters or from specified cows in the dairy herd. In some instances a limited tract of land is rented as a project and operated with power and implements furnished from the home farm. Generally, such land is used for the production of a special high-income crop. Where the acreage is large it may be used for the production of any of the normally grown

cash crops. The income from such projects goes to the project operator, who should, in case of an adverse year, stand any loss that may be met from low income, thus learning to meet hardship as well as good fortune.

Since the object in view is the accumulation of capital for further ventures toward the ownership of a farm, the operator should be encouraged to use his earnings in renewed productive enterprises as opportunities arise. Sharing in the responsibilities of the farm business develops initiative and gives valuable training. It also helps to establish self-confidence and good judgment. The record keeping and annual check-up on financial gains will also lead to thrift and the habit of objective saving, thus progressing toward eventual farm ownership.

It is impossible to outline all the forms which these project enterprises may take. Enough have been suggested to illustrate the idea. Fortunately, the Extension Services of the Agricultural Colleges in most states have been active in developing this type of work among young people and can give assistance, if wanted. Club and Chapter leaders, instructors in Vocational Agriculture, and County Agricultural Agents also are in position to give aid in developing programs for project work.

FARM PARTNERSHIP BASIS

In some instances where a son, or, in exceptional cases, a daughter, wishes to join in the operation of a farm, it may be advisable to work out a partnership agreement covering all operating activities. The form of such agreement will vary from case to case in accordance with the type of farming and the contributions that can be made by each party to it. In general, the father and the son will each contribute his labor and management to the partnership. Each party should receive a reasonable monthly or yearly wage allowance, or "drawing account," in proportion to the labor and management contributed and within the anticipated financial returns from the farm for the year.

Records Must Be Kept. Such partnership should be based on full and complete records of all farm transactions. It should begin with an appraisal of the value of the farm as a unit, recording separately the estimated values of land, buildings, wells, fences, and all other improvements that may be regarded as real estate. An inventory, showing ownership, amounts and estimated values of livestock, machinery, power implements, tools, feed, growing crops or grain, and supplies of all kinds will complete

the opening records. Records of cash receipts and expense must be kept. These records, with the annual inventory, will serve as the basis for an annual settlement and show the returns from operation and the proportion going to each party.

If the farm is not completely developed and buildings, fences, wells, drains, or other improvements are made on land owned by the father, the necessary money and labor are to be furnished by him. Should the son contribute labor or funds to such improvements, he would be entitled to receive pay for his contribution, when performed or when the partnership is closed, as may be mutually agreed.

Ownership Problems. Ordinarily, a son entering into such a partnership would own little or no personal property. This problem can best be met by the son's buying a one-half interest in that owned by the father. For the half interest taken over at inventory prices the son would give a note secured by the property purchased. This note would be retired by payments made as stock, crops, or other products in which he shares are sold or from his share of the income, when the annual settlement is made. Eventually he becomes a property owner.

Joint Account Advisable. In operating the farm under a partnership agreement, it will be best to put all cash receipts into a joint account open to both parties. Into such joint account would be entered all receipts from the sale of livestock owned in common, from livestock products, crops, and any other source covered in the agreement. The cash expense for feed, seed, hired labor, rent, taxes, new machinery, power, machinery repairs, telephone, electricity, and miscellaneous supplies would likewise be paid as operating expense out of the joint account. To one party or the other should be entrusted the task of keeping the records with mutual understanding as to the form and an agreement of the firm name in whose account the business will be transacted. If a checking account is maintained with a bank, agreement should be reached as to signatures and withdrawals. The checks may be signed by either party, by both, or by a firm name such as "John Doe & Son," when mutually agreed to and arranged with the banking house.

The net returns from operations may be determined at the end of the year by the amount left in the joint account after paying all cash expenses, including the monthly allowance for each partner and plus normal increases or minus decreases in the inventory of personal property.

Annual Settlement Desirable. In making an annual settlement, which is always advisable, there are two other items that should be taken into account:

1. As a full partner in the enterprise the son is entitled to living quarters and to one half of the food and fuel produced on the farm. He should, on the other hand, pay one half of the cost for purchased food and fuel. Ordinarily, this would be covered in the joint account from month to month; but, if not, it should be considered and adjustments made at the close of the year. The record should show adjustments required.

2. One party or the other may acquire a larger capital investment than the other. In that case, the one having the larger investment should be allowed interest, at a rate mutually agreed, upon his excess capital before the equal division of net returns is made for the year's operations.

Should it become advisable to close the partnership, an appraisal of all property owned in common should be made jointly. Settlement can then be made on the basis of the ownership share of each. If equal division of the property is not practicable or advisable, one party may agree to sell to the other at the appraised values. A provision for an arbitration committee, in case of disagreement, should be made in drawing up the partnership contract. Various states have forms which can be used as a pattern, although each partnership agreement is likely to vary in the details of the contract made.[1]

It is always advisable to put in writing the terms agreed upon for any such partnership contract. Verbal agreements, while valid if witnessed, are much more likely to be misunderstood than written ones. In writing the agreement all important items should be freely discussed until fully understood by both parties. Estimates of costs and returns to each party will help in gaining knowledge of probable equities. Agreement as to management and responsibilities should be included. Provision may be made for readjustments in the agreement if it is found, after a year or two of trial, that the original form results in unfair equity to one or the other party to it.

CLIMBING THE AGRICULTURAL LADDER

Many young men find it impossible to develop home project enterprises that result in satisfactory income or to work into a

[1] For examples see *Bulletin 244*, Minnesota Agricultural Extension Service; *Special Bulletin 330*, Michigan State College; and *Circular 587*, Illinois College of Agriculture.

fair partnership contract on the home farm. For them there is left the old process known as "Climbing the Agricultural Ladder." To do so is to work as a farm hand until sufficient capital has been accumulated to purchase power and equipment for operating a rented farm, and then to operate as a renter until sufficient capital is accumulated to make a substantial down payment on a purchased farm which is the final objective. While this process is slow, it has certain advantages that will bear further discussion and consideration.

Starting as a Farm Hand. One starting at the bottom of the ladder as a farm hand should keep the final objective in mind, else he may become discouraged at seemingly slow progress. Wages for farm hands are usually on a low scale. Working and living conditions are not good on all farms and frequently the work days are long. Before employment is sought a young man should observe carefully the farms, the equipment provided, the type of farming, and the management practices of possible employers. He should also give consideration to the reputation of each in regard to integrity and fair dealing. The period of employment should be looked upon as an apprenticeship as well as a job. One can learn much about farming and farm management by working under the direction of a good farmer. Good wages are a first consideration, but of equal importance are good living conditions and the educational influence of a good farmer. There is no other way in which farm experience can be gained at so little cost as by working for a first-class farmer.

To gain the farm ownership objective, wage saving must be firmly established as a habit. Living expenses in rural communities are low, as a rule, and a good share of the cash wage can be saved by a thrifty worker. On a cash wage of $40.00 a month it should easily be possible to save $300.00 to $350.00 a year. At that rate enough capital can be accumulated in the course of five to seven or eight years to buy a modest quantity of stock and equipment for the operation of a rented farm. Such a program does not allow for the purchase of a "jallopy" and frequent trips to neighboring towns, movies, and other money-catching devices. Rigid economy and self-denial are the price for financial progress. The savings made can be increased also by putting them to work. While interest rates are low, there are safe institutions in most communities that pay two to three per cent on deposits. Small-denomination government bonds pay fair returns on investments and can be converted into cash at any time desired. Other and

more favorable opportunities may be found locally, but one should remember that safety and liquidity rather than high interest rates must govern all dispositions of capital savings. In a slow-moving program such as this, one can not afford to risk losing one's savings.

BECOMING A TENANT. Any young man who has gained the reputation of being a good farm hand and who has saved from his earnings a sufficient amount of capital to provide a good part of the equipment needed will have little trouble in renting a farm in most communities. It will be to his advantage to rent a farm that is in good condition. It is particularly desirable that the soil be productive, reasonably free from weeds, well-watered and provided, where needed, with adequate drainage. It will be well to keep in mind that income from farming is made from the soil and not from the buildings. Good buildings are desirable on any farm, but they are second in importance to productive soil. While working as a farm hand, the prospective tenant may be able to locate such a farm as he will be satisfied to operate. It is quite possible that a good farm hand, employed on a good farm, may in time operate it as a renter and eventually become the owner by purchase. More frequently those persons who would rent farms in a community stand ready to purchase any desirable farm offered for sale at what is regarded as a good bargain. In purchasing, the tenant should have in mind the type of farming he desires to follow, the size of farm he can handle to best advantage, and the possibility of paying for it from the earnings.

FORMS AND TERMS OF LEASE CONTRACTS

There are many variations in the form of lease contracts used in the United States. Within the same form there are many variations agreed to which must be written into the lease when drawn. Only a few of the standard forms will be discussed here for purposes of illustration. Those wishing to study forms of lease contracts for specific use may obtain copies of the forms commonly used in their community from county offices or from lawyers practicing in the community. Reference is also made to the discussion of legal relationships in farming, Chapter XXXIII. The forms in most common use are: (1) Crop Share, (2) Cash and Crop Share, (3) Crop and Livestock Share, (4) Cash. Crop-Share leases are widely used and vary from locality to locality as custom and experience dictate. Discussion of some of the most common types follows.

CROP-SHARE LEASES

THE 1/4-3/4 CROP-SHARE LEASE. With this lease the landowner furnishes the land only, and frequently without buildings of importance. He gets in return for the use of the land on which he pays the taxes a 1/4 share of all crops grown, delivered at the local market free of all expense. The tenant supplies power, machinery, equipment, all labor, seed, and feed. He also pays the cash costs for harvesting, threshing, and storing or marketing. For these contributions he gets a 3/4 share of all crops grown.

This type of lease is found most frequently on the margins of wheat and small grain-producing areas in the north and west. It is used among the cotton growers of the South also, under the name of "Share-Cropper's" lease, for the cotton crop, but supplemented to give the landowner 1/3 of any grain crops grown. Usually the landowner gives little attention to the handling of the land except to reach agreement with the tenant as to the crops to be grown.

THE 1/3-2/3 CROP-SHARE LEASE. This type of lease is quite common throughout the United States except where very high land values prevail.

Under this lease the landlord furnishes the land, usually equipped with a modest and inexpensive set of farm buildings. It is usual to require that all straw, cornstalks, or other crop residue be used on the farm where grown and that manures, if any, be spread on the land.

The tenant furnishes horse or other motive power, all machinery and equipment, seed, feed, and all man labor required. He also pays all expenses for harvesting and threshing the crops, including twine and cash threshing costs, but not the marketing cost of the landlord's share.

The crops to be grown should be mutually agreed upon and specified in the lease, subject to modification from year to year. Of the major crops grown the landlord receives 1/3 and the tenant 2/3 at the farm.

Small acreages used by the tenant for corn, potatoes, or other special crops may be paid for in cash as mutually agreed. If land is to be seeded to grass, the landlord sometimes provides one half or all the grass seed and the tenant does the seeding. Hay cut from such seeding is usually put up by the tenant for which he gets a half share.

THE 1/2 AND 1/2 CROP-SHARE LEASE. This form of lease is widely used throughout the Corn Belt and to some extent in

many other parts of the United States. As with other leases, there are many variations in the terms as written into this lease in different communities, but the general terms are as follows:

1. The landlord provides the land and buildings, pays all taxes and insurance on real estate, furnishes the seeds of all kinds and pays one half the cash expense for threshing and, in some cases, one half the twine cost.

2. The tenant provides all horse or other power required, the machinery and equipment necessary in operating the farm, all man labor, and pays one half the cash expense for threshing and all taxes on his personal property.

3. The landlord receives one half of all grain crops delivered in bins at the farm or at a local elevator, if close by, as desired, also one half the hay in stack or mow as mutually agreed. If corn is raised, the landlord may choose between a half share unhusked in the field or two fifths if harvested and cribbed by the tenant.

4. Should the tenant own some livestock for which pasture is needed, it is customary to pay cash rent for the acreage needed. Cash rent is frequently paid also for land needed for special feed crops, potatoes, or other cultivated crops. The custom is growing also of making a moderate charge against the tenant for the use of buildings and farmstead. The tenant in most cases is expected to feed his horses from his own share of the hay and grain. Sometimes, however, a liberal-minded landlord will consent to share equally with the tenant the cost of feed for the horses.

Cash and Crop-Share Lease. In areas where farming is well diversified and considerable livestock is raised by tenants, leases are frequently made which combine cash and crop-share payments. In such instances the tenant gives a one-third share of all grain crops raised for which he furnishes the seed and pays all expense. In addition he pays cash rent at an agreed price for all land used for corn, hay, pasture, or other feed or cultivated crops. The price paid varies with the quality of the land and the purpose for which it is used. Prices will range from five to eight dollars or more for high-conditioned corn land to one to three dollars for hay and pasture land.

Crop and Livestock-Share Lease. Throughout the dairy and livestock regions of the United States a so-called 50-50 Crop and Stock-Share lease is quite commonly used among the best farmers. This, like all other forms of lease, varies widely from area to area, from state to state, and even within states. Many features of the lease are quite general, however.

1. The landlord, under the best form of this lease, furnishes the land and buildings, including the house for the tenant. He also furnishes one half of all foundation herds of productive stock.

2. The tenant provides horse or other power, tools, machinery and implements unless otherwise agreed, all labor required to operate the farm, and one half of the foundation herds of productive stock.

3. Seed and feed for all livestock are provided from farm-grown supplies so far as possible. If either must be purchased, the expense is borne equally by the two parties to the contract. Should tractor power be used, the expense for fuel and oil should likewise be equally divided. The tenant, however, is expected to keep his power and machinery in repair at his own expense. Repairs and additions to jointly owned equipment are a joint expense. The landlord furnishes the material for minor repairs on buildings and fences with the tenant furnishing the labor. Extraordinary repairs or improvements to real estate are borne by the landlord. Each party bears the taxes on individually owned property and shares equally the taxes on jointly owned property.

4. The income from all sales of crops, livestock products, and livestock are divided equally between the two parties. Each party is entitled to equal amounts of milk, cream, eggs, meat, or other farm-grown products for family use. Where one party uses more than the other, adjustments should be made at the end of the year. In practice the landlord does not always claim his full share.

5. Exceptions are made to the foregoing general policies in intensive dairy areas where the care of the dairy herd calls for a large amount of labor. In such areas it is quite common for the landlord to furnish all the cows and at least a half interest in the dairy bull. Where this practice is followed the owner's foundation herd is maintained by replacement of the older or poorer cows with heifers from the growing young stock. Unless the tenant gets half the proceeds from the cows sold, the landlord should pay him for his half interest in any heifers drawn into the herd. Records and inventories are requisite for settlement.

LEASE FOR COMPLETELY EQUIPPED FARM

In rapidly increasing numbers farm owners are adopting the plan of renting a farm fully equipped with power, machinery, tools, implements, and all classes of livestock to which the farm

is adapted. The tenant in such cases furnishes only the man labor required.

The income from a farm operated under this lease is divided between owner and tenant in proportion to the contributions made. On a farm devoted mainly to grain growing a one-fourth share of the gross income would give adequate returns for the labor performed. Where some cattle and hogs are raised, a one-third share would be more equitable. On a farm heavily stocked with dairy cows, hogs, and poultry a two-fifths share would not give to the tenant more than reasonable return for the labor performed. The owner is expected to pay all operating expense except that required for the employment of labor.

This lease has certain advantages for young men who have little or no capital with which to start farming. Under a favorable lease of a good farm it should be possible, with good management, to earn more than hired-hand wages. Under an experienced farm owner living nearby, assistance and direction can be given that will be helpful in planning production and producing and selling the products.

Naturally, a farm owner who risks his farm and livestock in the care of another will be careful in his selection of a tenant and somewhat exacting in the direction of the farm operations. Usually, this form of lease is made only when a prospective tenant has gained the reputation of being a good farmer and is known to be honest and reliable. It is sometimes used by a father who wishes to be relieved of the active labor of the farm and who has a son that is a competent farmer and wishes to start for himself.

THE CASH LEASE

In many of the richer agricultural areas where values of farm land are high, the cash lease is quite prevalent. This is a simple type of lease which, when the terms are once worked out and agreed to, gives the tenant almost complete control of the land so long as he carries out the agreement.

1. Under such a lease, the owner, for a cash consideration, puts at the disposal of the tenant his farm and buildings. In protection of the farm he should have written into the lease provisions for: (a) the maintenance of fertility through crop rotation and the use of manures, (b) the upkeep of buildings, fences, and other improvements, (c) the control of noxious weeds, and (d) the prevention of soil erosion. It is important, too, to know

that the prospective tenant is honest, competent, and financially able to carry out his agreement.

2. The tenant provides at his own expense all power, equipment, livestock, feed, seed, supplies, and all labor required to operate the farm and make ordinary repairs. In fact, within

TABLE V—ESTIMATED PROPORTIONATE EXPENSE TO LANDLORD AND TENANT IN PRODUCING SPRING WHEAT ON FALL-PLOWED LAND[1]

Item	Cost per acre Total	Expense Distribution			
		Half Share Lease		Third Share Lease	
		Landlord's expense	Tenant's expense	Landlord's expense	Tenant's expense
	Dollars	Dollars	Dollars	Dollars	Dollars
Seed—1¼ bu.	2.00	2.00	...	...	2.00
Man labor—12 hrs. @ 30c.	3.60	...	3.60	...	3.60
Horse work—15 hrs. @ 20c.	3.00	1.25*	1.75*	...	3.00
Twine	.32	...	.32	...	.32
Cash threshing	.56	.28	.28	...	.56
Machinery	1.50	...	1.50	...	1.50
Land use	3.00	3.00	...	3.00	...
General expense	.75	.50	.25	.50	.25
Total	14.73	7.03	7.70	3.50	11.23

*Horses fed from undivided farm supply.

the agreement carried in the lease contract, he operates the farm as though it were his own. He, of course, gets all products produced on the farm. Only tenants with a substantial accumulation of personal property and a moderate amount of capital can undertake this kind of a lease for a large farm.

Such leases are popular with landowners who wish to be relieved of the active management of farms, and when competent and reliable tenants can be found. It is popular also among well-to-do tenants who wish to be relieved of constant supervision and interference by overzealous landlords.

DETERMINING FAIR EQUITIES IN SHARE LEASES

When can it be said that the terms of a share lease are fair to each party to it? How determine when each party is getting what he should have? An exact answer is not easy, but an approximate estimate can be made that will show the gross inequalities, if such exist. It is much easier to make such estimates

[1] The same form of Table can be used for any other crops, and a summary made of the end results.

if annual inventories are taken and reasonably complete records of all farm transactions are kept.

It is obvious and generally agreed that a farm operated under an equitable lease will return to each party a share in the income that is in proportion to the share he bears in the cost of production. Just what that share is can be told only from

TABLE VI—PROPORTIONATE ANNUAL EXPENSE PER COW IN MAINTAINING A DAIRY HERD UNDER A 50-50 CROP AND LIVESTOCK SHARE LEASE[1]

Item	Total Cost in Dollars		Distribution of Cost	
			Owner	Tenant
Feed Grain	1,500 lbs. @ 1c.	$15.00	$ 7.50	$ 7.50
Roughage	2 tons @ 10.00	20.00	10.00	10.00
Silage	2½ tons @ 3.00	7.50	3.75	3.75
Pasture	1 acre	3.00	1.50	1.50
Man labor	130 hrs. @ 25c.	32.50	....	32.50
Horse work*	30 hrs. @ 15c.	4.50	1.50	3.00
Cow cost	Int. Dep. & D. Risk	23.00	23.00	....
Sire cost	Int. Dep. & D. Risk	4.00	4.00	....
Equipment	....	1.00	....	1.00
Bedding	2 tons @ 1.00	2.00	1.00	1.00
Gen. expense	....	1.00	.50	.50
Overhead on bldgs.	....	5.00	5.00	....
Total	....	$118.50	$57.75	$60.75

*Horses fed from undivided farm supply.

records kept or from careful estimates of comparative costs. These estimates will be most satisfactory if jointly worked out by both parties to the lease. Table V is a form that will be useful in accumulating the costs to each in crop production.

A first draft shows that under the "half-share" lease the returns to each are reasonably equitable. Were the landlord to pay half the twine cost and share equally the cost for horse work, nearly a perfect balance would be reached. Under the "third-share" lease, however, the tenant does not get a fair deal. One-third of the expense would be $4.91 per acre, but the landlord contributes only $3.50, which is $1.41 less per acre than his share. The tenant contributes $11.23, whereas two-thirds of the expense per acre would be only $9.82. He is, therefore, contributing $1.41 more per acre than the lease calls for. A ¼ share to the landlord and a ¾ share to the tenant would be in better proportion to the contributions made than the ⅓-⅔ share lease proposed.

[1] Hypothetical Example.

Similar estimates can be made covering proportionate costs of maintenance of a dairy herd, a herd of beef cattle, a swine herd, or other classes of livestock. Table VI gives a list of the items that should be considered and an arbitrary estimate of the costs per cow to each, landlord and tenant, of maintaining a dairy cow on a 50-50 crop and stock share lease on a dairy farm where the landlord furnishes the cows and sire.

Analysis shows this to be a fairly equitable lease contract. The allowance for overhead charges for the buildings is probably lower than it should be. Cow costs and sire costs are based on cows valued at $125.00 and a sire at $300.00. If better-quality cattle are furnished, the landlord's share of the cost would be higher. The tenant's only chance to lower his costs is to reduce the hours of labor spent on cows, which is already very low.

Such estimates, made before a lease is consummated, will be helpful in setting up equitable terms under which to operate. Then a carefully drawn lease, into which is written all the details of agreement and specification, will go far in avoiding misunderstandings, disagreements, and discontent.

THE TOP OF THE LADDER, A PURCHASED FARM

After a successful experience as a farm hand and as a tenant operator, one may well give consideration to the matter of purchasing a farm, provided that one wishes to stay permanently in the business of farming. Ownership of a good farm gives independence of action and freedom from irksome supervision from landlords or others. It also removes the uncertainty of tenure experienced in renting, and avoids the possibility of frequent interruption of operations and expensive moving. One should buy with care, however, as paying for a farm out of earnings is a long-time task. A false start and a bad bargain may be much worse than continuing as a tenant. The purchase of a family farm is a most important business transaction.

The Earmarks of a Good Farm. A long-time acquaintance with a farm and its past history affords the best knowledge of its value. Where that can not be had, there are other means of estimating its value. First, one should buy, if possible, in a well-developed community where thrifty farms and good buildings are in evidence. The productive power of the land in a community is usually expressed in the buildings found to prevail on the farms. Universally, good buildings are seldom found on infertile, unproductive land. Poor soils do not produce good build-

ings. A first impression of the quality of a community can be gained by a drive through it, and observing the condition of buildings and fields.

Location of a farm in relation to roads, markets, schools, churches, and neighbors is also important in the final selection of a farm. But of utmost importance is the quality of the soil. This may be clearly indicated by the nature of the trees, crops, or other vegetation growing on the land. Large, vigorous trees and heavy vegetation indicate a fertile, productive soil. One should also explore the soil as to depth, texture, and moisture content, and give consideration to topography, drainage, and freedom from stone. One should always keep in mind the fact that the soil produces the wealth of the farm.

As additional information, tax rates in the township should be checked and inquiry made as to special school, ditch, road, or other special taxes. Finally, it may be well to check judgment with a few experienced farmers in the neighborhood who know land values. Buying a poor farm is a costly experience.

WHEN TO BUY. The temptation to buy a farm is always strongest during a period of prosperity. The tendency at such times is to pay higher than normal prices for land. As paying for a farm is likely to be stretched over a period of ten to thirty years, it is quite likely that at least a part of the payments will be made in periods of depression, when prices of farm products are low and dollars are hard to get. It is better to continue as a renter on a good farm, if one can be had, during a boom time, and purchase a farm in a period of depression when a bargain can be found. Bargain for the farm in a depression period and pay for it during periods of general prosperity is a good rule to follow. But such a rule is not easy to follow, because it is difficult to tell how long a period of prosperity may last or just when or how fast it will break. There are signals, however, that may roughly serve as warnings of movements in the land market.

A period of rising prices and increasing farm incomes coupled with an increasing number of land sales is a danger signal. At such times the demand for land is strong and competitive bidding is likely to force prices up sharply. One who has little cash for a down payment should avoid buying at such times unless he knows he is getting the farm at a normal value and on favorable payment terms. Fortunately, such periods are favorable to tenants who are able to lease good farms. It may be better judgment to continue as a renter for a few years, if pos-

sible, and accumulate more equipment and capital rather than to attempt to purchase a farm on a rising market.

While it is hard to get up enthusiasm for farming during periods of low prices for farm products, the one who buys a farm at such times can get more for his money than the one who buys on a rising market. The capital accumulated as a tenant during good times will enable a larger down payment to be made. This larger payment adds to the safety of the investment and reduces the amount of interest to be paid. Much more peace of mind and freedom from worry can be had on a rented farm than on a farm heavily overburdened with debt. Some of the best farming in the world is done by tenant farmers.

The best bargain for a farm can usually be made with an owner who wants to sell. It is often possible to find an old couple who are left alone or have no children interested in farming and who wish to retire. Estates that are being settled sometimes present opportunities for buying at good values. Insurance company holdings, banks, and other lending agencies frequently afford good bargains in farm lands. All such possibilities should be carefully explored by the prospective purchaser. One wishing to make a wise purchase may well spend considerable time in searching for a farm that is adapted to his needs and that is owned by someone who wishes to sell.

How Much Is the Farm Worth? Having found what appears to be a desirable farm, it becomes important to know how much should be paid for it. One should obtain all possible available information about the farm. There are several sources where needed information may be gained.

1. Tax assessment records and tax levy records can be found at county seats. The records should be carefully studied. These will reveal taxes assessed against the farm in the past and show special tax levies or bonded indebtedness of the district for roads, drainage, school, or other purposes. Farms lying adjacent to villages or cities are likely to be included in a special tax district where rates are abnormally high, thus throwing a heavy tax burden upon them. Heavy taxes detract from the net income of a farm, and, therefore, reduce its value.

2. Information on the productive history of most farms can now be gained from the county AAA offices. The productivity rating of the farm, restrictions on the production program, and the acreage of soil-depleting and soil-building crops permitted or required can be learned from this source.

PLATE IX. THE FIRST STAGES OF SOIL EROSION

Rain water running down the slopes carries with it the finer particles of soil, thus starting soil erosion. The farm operator must be constantly on guard against serious losses from this source.

PLATE X. CONSERVING MOISTURE AND PREVENTING EROSION

The terraces in this field delay the run-off and the soil absorbs more of the rainfall, thus increasing the stored moisture for crop production.

PLATE XI. AN EXAMPLE OF STRIP CROPPING

To prevent erosion on slopes and hillsides, the land is cropped in strips 100 to 150 feet in width. These strips follow the contour lines of the land, providing for gradual flow of water downward along the side of the hill. Grass crops are alternated with grain and cultivated crops to delay the run-off of falling rain water.

PLATE XII. FARM STOCK WATER PONDS

Farm ponds are becoming increasingly popular. The one pictured here, built with a bulldozer, covers three-fourths of an acre and is protected from grazing. The horses are near the stock watering tank. Courtesy Soil Conservation Service.

3. Soil survey bulletins are available for many counties. These give a description of the soils and a somewhat detailed classification by physical texture and topography.

4. Careful inquiry should be made as to past sales in the vicinity and prices paid for similar farms. Information on these points may be gained from neighbors and, to some extent, at the county courthouse.

5. United States Census reports give the average farm values by counties for farms of different sizes. These may be valuable in showing comparative values and as a basis for estimating how much above or below the average a specific farm is.

6. The most important source of information is the farm itself. A thorough physical examination of the farm under consideration is of the utmost importance. The purpose is to observe and appraise topography, drainage, soil, and other physical characteristics in relation to productivity. This information may then be used in estimating a fair rental price, or as a base on which an offer to purchase may be made. Obviously, the buildings should be checked to determine their suitability, the outlay, if any, needed to put them in condition for use, and the annual maintenance charge against the land.

VALUE BASED ON INCOME. In the final analysis, the value of a farm is based on the income it will produce. One way to determine a value or offering price on a farm is to figure the rent that a farm would bring either under the share or cash system. A rental bringing $3.00 an acre net rent is returning 4% on $75.00 land. At present money values, that is a higher rate than is being returned on government bonds or other long-time investments. A farm bringing a rental income of $2.00 an acre would not warrant payment of more than $50.00 an acre at a money rate of 4%. Because of particularly favorable location or other attractive features, the buyer may wish to offer somewhat more than is indicated by the rental value, or, in the hope of driving a favorable bargain, he may offer something less, particularly if he finds the owner anxious to sell. It is the net income value, however, that is likely to be available to pay the interest on the mortgage.

DOWN PAYMENTS ON PURCHASE. The amount of the cash, or "down payment," on a farm will depend on the ability of the buyer to pay and the willingness of the seller to give credit. Some sellers insist on an all-cash payment. They usually will sacrifice something on the price for a quick cash sale. Few buyers, and

particularly tenants, are prepared to buy for cash. The down payment, therefore, becomes a matter for bargaining between the two. Few sales are made with less than 10% of the selling price paid in cash. More frequently, 20% or more is required. If less than 20% of the selling price is paid in cash, it is customary for the seller to give a contract for a deed, and the seller to withhold the deed until 25% to 50% of the agreed price has been paid.[1]

As a matter of business policy, the buyer should make as large a down payment as possible, in order to avoid excessive interest charges. Buyers with limited capital, however, who must borrow heavily should bear in mind the sources of credit and the comparative cost of money for different purposes. Ordinarily, lower rates of interest can be obtained on long-time real-estate loans than on short-time chattel loans. It is advisable, therefore, to reduce as much as possible or eliminate entirely interest on short-time loans. Where one has livestock and equipment clear of loans and mortgages, a long-time amortized loan can usually be made on real estate at a low rate of interest. It is, therefore, good policy to continue to operate as a tenant until personal property has been cleared and sufficient cash has been accumulated to permit a down payment of at least 20% to 25% of the purchase price. An exception might be made at any time that a particularly productive farm can be bought at a bargain price. If credit must be sought, it will be well to negotiate with a number of loan agencies to learn where the most advantageous terms can be had. The sources of co-operative credit offered by the Production Credit Association, The Federal Land Bank and other units of the Farm Credit Administration are available for sound loans at low rates and on long-term amortization plans.

OTHER MEANS OF ACQUIRING A FARM

Three other methods of acquiring a farm have been passed over, but should be mentioned, though they do not enter into the present study. They are: (1) by Homestead Entry, (2) by Gift, (3) by Inheritance.

1. In the past, when the Federal Government held title to large areas of land, those who were willing to undergo the hardships of pioneer life could secure the right to a given property by Homestead Entry. It involved the payment of $1.25 an acre

[1] The nature of contract, deed, title, and other legal terms are discussed in Chapter XXXIII.

and the construction of certain buildings within a specified time. Free land of quality suitable for farming is no longer available, and opportunities for homesteading are rare and of meagre importance.

2. Acquirement by gift is comparatively rare and lies entirely outside of academic discussion or influence.

TABLE VII—ACREAGE, YIELDS, AND TOTAL PRODUCTION OF EACH CROP AND AMOUNT AVAILABLE FOR USE OR SALE UNDER THREE DIFFERENT PLANS OF ORGANIZATION

Crop	Yield per acre	Budget I Acres	Budget I Total yield	Budget II Acres	Budget II Total yield	Budget III Acres	Budget III Total yield
Oats	46 bu.	17.6	810 bu.	12.0	552 bu.	....	....
Barley	40 bu.	9.4	376 bu.	15.5	620 bu.	....	....
Oats and barley	54 bu.	9.2	497 bu.	25.5	1,377 bu.	41.0	2,214 bu.
Oats, barley and wheat	36 bu.	22.0	792 bu.	....	....	....	....
Wheat	18 bu.	5.4	97 bu.	....	....	....	....
Ear corn	58 bu.	17.2	998 bu.	14.0	812 bu.	31.5	1,827 bu.
Silage corn	9.0 T.	12.6	113.0 T.	13.5	121.5 T.	8.0	72.0 T.
Alfalfa, tim. and clover	1.4 T.	4.2	5.9 T.	....	....	....	....
Alfalfa and timothy	2.0 T.	13.9	27.8 T.	25.5	51.0 T.	25.5	51.0 T.
Timothy and clover	1.1 T.	.9	1.0 T.	....	....	....	....
Reed's Canary grass	3.4 T.	3.7	12.6 T.	4.1	13.9 T.	4.1	13.9 T.
Rotation Pasture	....	20.4	....	27.5	....	27.5	....
Permanent pasture	....	10.8	....	10.8	....	10.8	....
Total Concentrates—lbs.	....	....	157,780*	....	142,978*	....	186,972*
Total hay—lbs.	....	....	94,600	....	129,800	....	129,800
Total silage—lbs.	....	....	226,000	....	243,000	....	144,000

*An allowance for seed has been deducted. Corn is calculated at 56 pounds per bushel.

3. Acquirement by inheritance, while logical, desirable, and common in practice, involves a relatively small proportion of the farms of America. Partial inheritance is more common and involves partial purchases open only to members of a family group. No general discussion of these matters is needed here. For legal procedure in such matters see Chapter XXXIII.

A BUDGET TEST OF FARM EARNING POWER

A final check on the wisdom of the choice of farm for rental or purchase can be made by checking the earning power of the farm through an estimated budget test. A farm budget is a plan for the future use of the land, with an estimate of the probable returns from each crop and class of livestock. It involves

TABLE VIII—ESTIMATED FEED REQUIREMENTS FOR LIVESTOCK UNDER THREE DIFFERENT BUDGET PLANS OF ORGANIZATION

Class of Livestock	No.	Pounds per Unit: Con-centrates	Hay	Silage	Milk	Total Pounds Feed: Con-centrates	Hay	Silage	Whole Milk	Skim Milk
BUDGET I										
Horses	2	2,600	2,850	......	....	5,200	5,700	....	......	......
Dairy Cows	18	1,358	2,855	9,844	....	24,444	51,390	177,192	......	......
Bull	1	750	3,000	4,000	....	750	3,000	4,000	......	......
Heifers—2 years	5	600	3,000	2,500	....	3,000	15,000	12,500	......	......
Heifers—1 year	5	400	2,000	2,000	....	2,000	10,000	10,000	......	......
Calves—under 1 year	5*	200	750	500	336 wh. 2,540 sk.	1,000	3,750	2,500	1,680	12,700
Calves—veal	11	......	......	......	480	....	....	....	5,280	......
Boar	1	600	......	......	....	600	....	....	......	......
Sows—over 200 lbs.†	7	200	......	......	....	1,400	....	....	......	......
Pigs	134 cwt.	440	......	......	735	58,960	....	....	......	98,490
Hens	250	75	......	......	20	18,750	....	....	......	5,000
Chicks	400	30	......	......	....	12,000	....	....	......	......
Total Required	......	......	......	......	....	128,104	88.840	206,192	6,960	116,190
Total Available	......	......	......	......	....	157,780	94,600	226,000	6,960	116,480
BUDGET II										
Horses	2	2,600	2,850	......	....	5,200	5,700	....	......	......
Dairy Cows	25	1,358	3,335	8,404	....	33,950	83,375	210,100	......	......
Bull	1	750	3,000	4,000	....	750	3,000	4,000	......	......
Heifers—2 years	6	600	3,000	2,500	....	3,600	18,000	15,000	......	......
Heifers—1 year	6	400	2,000	2,000	....	2,400	12,000	12,000	......	......
Calves—under 1 year	6	200	750	500	336 wh. 2,540 sk.	1,200	4,500	3,000	2,016	15,240
Calves—veal	16*	......	......	......	480	....	....	....	7,680	......
Boar	1	600	......	......	....	600	....	....	......	......
Sows—over 200 lbs.†	9	200	......	......	....	1,800	....	....	......	......
Pigs	156 cwt.	410	......	......	880	63,960	....	....	......	117,920
Hens	250	70	......	......	40	17,500	....	....	......	10,000
Chicks	400	30	......	......	....	12,000	....	....	......	......
Total Required	......	......	......	......	....	142,960	126,575	244,100	9,696	143,160
Total Available	......	......	......	......	....	142,978	129,800	243,000	9,696	143,104
BUDGET III										
Horses	2	2,600	2,850	......	....	5,200	5,700	....	......	......
Beef Cows	20	......	3,382	4,855	....	....	67,640	97,100	......	......
Bull	1	......	3,500	2,000	....	....	3,500	2,000	......	......
Heifers—2 years	5	......	3,382	4,855	....	....	16,910	24,275	......	......
Heifers—1 year	5	......	1,750	2,250	....	....	8,750	11,250	......	......
Calves—under 1 year	5	400	750	750	....	2,000	3,750	3,750	......	......
Calves—to 400 lbs.	14*	200	375	375	....	2,800	5,250	5,250	......	......
Feeders—above 400 lbs.	84 cwt.	575	225	......	....	48,300	18,900	....	......	......
Hens	250	77	......	......	....	19,250	....	....	......	......
Chicks	400	30	......	......	....	12,000	....	....	......	......
Boar	1	600	......	......	....	600	....	....	......	......
Sows—over 200 lbs.†	15	200	......	......	....	3,000	....	....	......	......
Pigs	213 cwt.	440	......	......	....	93,720	....	....	......	......
Total Required	......	......	......	......	....	186,870	130,400	143,625	......	......
Total Available	......	......	......	......	....	186,972	129,800	144,000	......	......

*Estimated calf loss per year Budget I, 2; Budget II, 3; Budget III, 1.
†Gilts transferred from young pigs at 200 lbs.

also an estimate of the amount of livestock to be kept, of the amount of feed required by them, of the pasturage needed, and of feed purchases. The hours of man labor and horse work should also be calculated as closely as possible and compared

with the available supply. Against the income from all sources must be checked the probable costs and expenses for operation. The difference indicates approximately the net income that may be expected under the plan. Two or three alternative budgets should be set up showing the results from changed acreages of crops or different combinations of crops and livestock. The one offering the greatest returns for the labor and materials ex-

TABLE IX—EXPENSES THAT VARY WITH DIFFERENT TYPES OF ORGANIZATION

Expense	Budget I		Budget II		Budget III	
	Quantity	Value	Quantity	Value	Quantity	Value
Crops:						
Alfalfa Seed @ $1.05 per A.	13.5 A.	$ 14.17	25.5 A.	$ 26.78	25.5 A.	$ 26.78
Hog Pasture Mixture @ 65c per A.	2.0 A.	1.30	2.0 A.	1.30	2.0 A.	1.30
Pasture Seed @ 84c per A.	20.0 A.	16.80	25.5 A.	21.42	25.5 A.	21.42
Twine @ 22c per A.	63.6 A.	13.99	53.0 A.	11.66	39.0 A.	8.58
Threshing	....	90.56	....	89.56	....	73.71
Hybrid Seed Corn @ $6.00 per A.	2.4 bu.	14.40	2.0 bu.	12.00	4.5 bu.	27.00
Silage Corn Seed @ $2.00 per A.	4.2 bu.	8.40	4.5 bu.	9.00	2.6 bu.	5.20
Cash Expenses for Tractor—31c per hr.	194.0 hr.	60.14	168.0 bu.	52.08	178.0 hr.	55.18
Total	....	$ 219.76	....	$ 223.80	....	$ 219.17
Livestock:						
Interest on Investment @ 5%	....	137.80	....	180.05	....	141.85
Miscellaneous Cash Exp.	....	37.00	....	49.00	....	28.00
Equipment Expense	....	87.00	....	97.00	....	24.00
Tankage @ $50 per ton	....	....	....	....	4.26 ton	213.00
Total	....	$ 261.80	....	$ 326.05	....	$ 406.85
Other Expenses:						
Hired Labor @ $44.50 per mo.	12 mo.	534.00	12 mo.	534.00	7 mo.	311.50
Board for Labor @ $16.00 per mo.	12 mo.	192.00	12 mo.	192.00	7 mo.	112.00
Day Labor @ $3.00 per day	....	....	25 da.	75.00	....	....
Board for Day Labor @ 50c per day	....	....	25 da.	12.50	....	....
Total	....	$ 726.00	....	$ 813.50	....	$ 423.50
Total Variable Expenses	....	$1,207.56	....	$1,363.35	....	$1,049.52

pended is the one that should, in the end, be adopted. A sample farm budget study is offered to illustrate its usefulness.

Assuming that this farm is for sale or rent, the prospective operator wants to know something of the earning power of the farm and which system of organization will give the greatest return.

Budget I assumes the original organization as shown in Figure 20, Chapter XIII and Table XXII, Chapter XIV, before revision of the cropping season, except that the power is furnished by a tractor and two horses, as suggested on page 220, Chapter XVII.

Budget II is an organization using the revised cropping system as shown in Figure 22 and Table XXIII, Chapter XV. The dairy herd is increased by seven cows and two more sows are kept. This plan utilizes all the feed produced on the farm. The power is furnished in the same way as in Budget I.

Budget III shows a beef-breeding herd of 20 cows. The calves are to be born in the spring and run with the cows on pasture during the summer. Five calves are to be kept for replacements of cull cows and the loss of one calf per year is expected, leaving 14 head to be put in the dry lot and fed out as baby beeves. Fifteen sows will be bred to farrow in April with two bred for fall pigs to follow the feeding cattle. The cropping

TABLE X—ESTIMATED INCOME UNDER EACH BUDGET

Source	Budget I		Budget II		Budget III	
	Quantity	Value	Quantity	Value	Quantity	Value
Dairy:						
Butterfat @ 28c per lb.	4,320 lbs.	$1,209.60	6,000 lbs.	$1,680.00		
Cull Cows @ $35.00 each	5	175.00	6	210.00		
Veal Calves @ $15.00 each	11	165.00	16	240.00		
Total		$1,549.60		$2,130.00		
Beef Cattle:						
Cull Cows @ $33.00 per head					5	$ 165.00
Baby Beeves @ $8.00 per cwt.					14,000 lbs.	1,120.00
Total						$1,285.00
Hogs:						
Sows @ $5.00 per cwt.	2,450 lbs.	122.50	3,150 lbs.	157.50	5,250 lbs.	262.50
Pigs @ $6.50 per cwt.	12,000 lbs.	780.00	13,800 lbs.	897.00	18,300 lbs.	1,189.50
Total		$ 902.50		$1,054.50		$1,452.00
Poultry:						
Springs @ 40c each	125	50.00	125	50.00	125	50.00
Old Hens @ 35c each	50	17.50	50	17.50	50	17.50
Eggs @ 16c per doz.	2,470 doz.	395.20	2,470 doz.	395.20	2,470 doz.	395.20
Total		$ 462.70		$ 462.70		$ 462.70
Crops:						
Barley @ 45c per bu.	599 bu.	269.55				
Total Receipts		$3,184.35		$3,647.20		$3,199.70
Less Variable Expenses		1,207.56		1,365.85		1,049.52
Total		$1,976.79		$2,281.35		$2,150.18

system is the same as that shown in Budget II, except that 1½ fields are used for corn and 1½ fields are used for small grain. The investment in feed bunks, outside racks for hay, and remodeling of barn (removal of stanchions, etc.) will about offset the investment in dairy equipment.

The organization under Budget I requires the labor of two men but does not make full utilization of this labor. The work is distributed in such a way that the hiring of a man during the crop season will not solve the problem, because it will leave too much for one man during the balance of the year. The organization under Budget II utilizes more fully the labor of the operator and one full-time hired man. The labor requirements of the organization shown in Budget III can be handled by the

operator, except during the crop season. A man would need to be hired for seven months.

Only the expenses that vary with changes in the organization have been shown in the budgets. For example, in comparing Budget I with Budget III, note that the twine cost is much higher in Budget I, because more small grain is raised. More corn is raised under the system shown in Budget III, consequently the cost of hybrid seed is about twice as much as for Budget I. The returns shown by the three budgets do not show how much money the operator will have to spend but show the relative returns to be expected by each of the three methods of operating the farm under normal operating conditions.

In comparing the returns above, variable expenses are shown in the three budgets. Budget I shows $1,976.79, Budget II, $2,281.35, and Budget III, $2,150.18. This variation does not represent the money available to spend but shows that returns from Budget II are $304.56 more than from Budget I, and $131.17 more than from Budget III. It also shows that returns from Budget III are $173.39 more than from Budget I.

The other items of expense such as rent, interest, taxes, insurance, upkeep, and depreciation on buildings and machinery, and miscellaneous expenses would be the same whether the farm was operated as a dairy farm according to Budget I or whether it was operated as a beef-breeding farm according to Budget III. In order to arrive at a figure showing the amount of money available to the operator for spending, it would be necessary to include the above expenses with the variable expenses shown in the budgets for a fair comparison.

The prices used in the budgets for products sold are the average for the period 1930-1939. There is only a small difference of $131.17 between operating the farm as a dairy farm, as shown in Budget II, or as a beef-breeding farm, shown in Budget III, when these prices are used. The choice of organization in this case would very likely rest with the preference of the operator for dairy farming or beef farming. Different prices might have an important effect on the choice of organization for this farm. If the butterfat prices used in the budgets had been 35c per pound and all other prices had remained the same, then the returns from the dairy organization shown by Budget II would have been $2,701.35, or $550.17 more. If the butterfat price had been 20c a pound and the price of beef unchanged, then the returns from the beef-breeding organization would remain at

$2,150.18 and the returns from dairying represented by Budget III would have been $1,801.35, or $348.83 less. Similar comparisons can be made by varying the price received for hogs or beef cattle or by varying weights or quality.

The suggested budgets have in no way exhausted the possibilities of organization on this farm but have served merely as examples of the method. A prospective operator would undoubtedly want to try others. Errors made in selecting the wrong kind of organization are not so serious when made on paper, since the trial plan of organization can easily be discarded; but, if the wrong kind of organization is actually set up on a farm, it may eventually end in bankruptcy. The budget method offers an inexpensive way of trying out different systems of organization to determine the most profitable way of organizing a particular farm business.

✓Chapter IX

PRINCIPLES OF SOIL AND CROP MANAGEMENT INVOLVED IN FARM ORGANIZATION

Many of the operations concerned with crop growing are common to all crops. Others are specific for a special crop and not applicable to other crops. Plowing the land as a first step in the preparation of the land for cropping is an example of the first group. Hand-pollinating of corn in producing hybrid seed stocks is an example of the second group. Between these two extremes lie all sorts of operations more or less applicable to the production of many crops. Certain principles are here outlined which will be useful to the operator in determining when it may be wise to apply the standard treatment or resort to some special operation. The principles involved are:

1. Each crop should be given its most favorable environment and conditions for growth and development. Optimum conditions can not always be supplied; but, so far as possible, the natural-growth habits of the crop should be recognized and provided for.

2. Each operation in the processes of producing each crop should be so timed as to give the most favorable conditions for growth and the development of quality in that crop. Spring wheat, for instance, germinates and stools best in the cool days and nights of early spring. Early-seeded wheat nearly always makes the best yields and the best quality. Corn, soybeans, and Sudan grass, on the other hand, make the quickest germination and the best growth when planted later in soil well warmed by the sun's rays. Tillage operations and harvest likewise must be timed to provide the best conditions for promoting rapid growth and good quality.

3. Permanently productive land can be insured only by good handling and management. The operator of a farm must, therefore, keep in mind the need for restoring in some manner the elements of fertility removed with each succeeding crop. Plans for maintaining the producing power of the farm should be included in the cropping program. Barnyard manures and commercial fertilizers, combined with crop rotations and green manure crops, are the means usually employed.

4. Economy of operation is always in order. Economy does not mean skimping the operations. It does mean expending resources and labor where they will bring largest returns. There is nothing gained in using three bushels of barley seed an acre if two bushels will give an equal yield, as it usually does. One cultivation at the right time may be worth more than two given at the wrong time. On the other hand, an extra tillage operation may mean sufficient improvement in quantity or quality to bring greater returns on the market.

These are all matters that call for judgment and decision on the part of the operator. No rule for action can be laid down, but the principles outlined, if followed, will result in consistently good results from the crops grown. There are other matters common to many crops that bear on successful and economic production that will next be considered.

SOIL MANAGEMENT

Crop production is based largely on the soil and its management. Good crops are not grown on poor soil or on soil that is out of condition. Not all soils can be made suitable for cropping, but many can be improved by good management. One of the first points to observe is the moisture conditions. It is well known that plants can not grow without water. Neither can farm crops be grown if there is too much water. To maintain good balance in the soil moisture supply, therefore, becomes a major problem.

DRAINAGE is the remedy where too much moisture frequently leaves water standing in the fields. Drainage may be accomplished by either open ditches or by closed tile drains systematically laid. The latter, while more expensive, are the more desirable for several reasons. Tile drains buried beneath the surface present no obstacles to field tillage in any direction desired. Open ditches, if deep, cut the fields up into awkward shapes and often cause loss of time by extra turns or by long distances traveled to reach a crossing place. The extra cost of the tile may be offset in many cases by the saving of time in working the fields. Which method to employ is a matter that can be determined only by the operator, who, with assistance from a drainage expert, can figure out the relative merits and expense of the two systems of drainage for the land to be drained. A farm is not fully organized until adequate provision has been made for the control of excess soil moisture.

Space does not permit a discussion of drainage methods.

Where fields are to be drained or a drainage system laid out for a farm, it is advisable to employ a drainage engineer familiar with drainage methods. Many of the State Experiment Stations have published helpful bulletins on the subject. They can be had for a post-card request.

SUPPLYING MOISTURE. It is more difficult to supply moisture when there is a deficiency under natural conditions than to provide drainage when needed. In an irrigation district it can be supplied, when water is available, by putting in a system of irrigation ditches and turning on water when need for it is indicated. Only a small portion of the land of the United States is served by irrigation waters. Fortunately, large areas of good agricultural land are located in regions where the annual precipitation normally is ample for crop production. By correct tillage methods good crops can be grown even where precipitation is somewhat limited. To give moisture-conserving tillage requires knowledge of elementary soil physics and of the movement of water in the soil.

First, we should note what happens when it rains. Heavy rainfall is marked by two movements. Some of it runs off over the surface, seeking a common level through the force of gravity. This movement is plainly noticeable. At the same time some of the rain water is absorbed into the soil and moves downward, also by force of gravity, to the point where it reaches a static water level or reservoir. When the rainfall is light and the soil dry, gravitation will carry the water downward only to the point where gravity is overcome by adhesion of the water to the soil particles with which it comes in contact. Movement of water into the soil is not easily observed, but examination of the soil after a rain will prove the case. Numerous examinations by soil scientists give evidence that water percolates downward much more rapidly in porous, sandy, or gravelly soil than in dense clay or silt. The movement downward will be retarded if the spaces between the soil particles are well supplied with humus (organic matter), which will absorb and hold the water.

After the rain is over and the sun shines, the water in the soil begins to move up toward the surface. The sun and wind dry the surface soil and evaporation stimulates the movement of water upward by capillary action. The roots of plants come in contact with the soil particles and draw nourishment for the plant from the watery solution adhering to them. The plants move water out of the soil by transpiration through the tissues as growth is

made. The size of the soil particles, the quantity of organic matter in the soil, and the tillage practices followed, vitally affect the movement of water into and out of the soil. They are, therefore, important matters in crop production.

Water moves downward rapidly in a coarse sandy soil. It often gravitates downward beyond the reach of the plants. Because of the coarse soil particles, capillary action is poor and crops on sandy land may suffer from drouth unless rains are frequent. The addition of manures or green manure crops that supply organic matter will improve such soils. The decaying organic matter acts as a sponge to absorb and hold the moisture within reach of the plants. While commercial fertilizers can be used on such soil, there is likelihood of much loss because of their leaching downward out of reach of the plants during periods of heavy rainfall. On clay and clay-loam soils the soil particles are smaller and the movement of water downward is much slower and the movement upward more rapid than on sandy soils. Such soils are less likely to be drouthy than sandy soils. There is also less danger of loss of fertility from leaching. Commercial fertilizers may, therefore, more safely be used on them, should the farm not provide sufficient barnyard manures for all the fields. By recognizing these well-established facts the farm operator can so modify the treatment of his fields as to insure the best possible moisture conditions for his growing crops on each field.

Moisture can be accumulated in the soil also by retarding the run-off from heavy rainfall. Furrows drawn on contour lines along the sides of slopes or hills, to catch the run-off and prevent rapid flow over the surface, effectively increase the supply of soil moisture. The distance of the furrows apart will depend on the nature of the soil, the slope of the land, and the anticipated volume of rainfall. On the southern Great Plains plow furrows drawn 100 to 200 feet apart on nearly level grazing land have materially increased the quantity of water absorbed into the soil from rainfall. In areas of frequent heavy showers and quick run-off, the furrows, or rounded ditches of greater depth, may be more closely spaced. The fall of the contour furrow should be so moderate as to hold the water in the furrows nearly level, thus increasing absorption and decreasing the rapidity of run-off and the danger of gullying.

SOIL CONSERVATION METHODS

American farmers are rapidly awakening to the importance

of soil conservation. The United States Department of Agriculture, in co-operation with the State Colleges of Agriculture, has conducted extensive educational campaigns to demonstrate methods of preventing soil waste from erosion. Volumes have been written about the millions of tons of good soil that have been washed into the rivers and transported to lower levels and out to the oceans. But erosion still goes on and will go on until each operator of a farm does all that is economically and humanly possible to prevent it. Attention is now turned toward some of the practical methods employed to stop erosion that are within the ability of most farmers to provide.

Keep Rough Land in Grass. Experience has shown that land covered thickly with grass does not erode or erodes but slowly. The more level land will erode but little if kept in grass and legume crops. Very rough land is subject to some sheet erosion and to gully erosion where the surface is cut by wagon wheels or by the hoofs of animals traveling frequently in the same path or trail. The remedy is to minimize the travel over such land and control the travel of livestock on it. Hardy, persistent grasses, such as Kentucky bluegrass, brome grass, or even the troublesome quack grass should be used in the ravines and waterways where the heaviest run-off occurs. A good stand of alfalfa or of alfalfa with mixed grasses may be used to advantage on the less rough portions of the land. The application of manures or commercial fertilizers at times to stimulate vigorous, active growth is advisable. Rotation grazing of pasture land and undergrazing, rather than overgrazing, will do much to preserve the grass stand and to prevent erosion. Light-footed animals, such as sheep or goats, will cut the surface less than horses or cattle and should be used on the rough land where good farm economy permits.

Strip Cropping. On most farms a large part of the land must be used for other than pasture crops. Cereal grains, corn, and hay must be provided for winter feeding. Often cultivated crops, such as soybeans, are wanted for feed. Sugar beets or potatoes may fit in as cash-sale crops. On hilly lands these crops, grown in systematic rectangular fields, are likely to lead to gullying and heavy sheet erosion. The modern way to meet the problem of erosion on such farms is to develop systems of strip cropping adapted to the conditions prevailing on each individual farm. The tillable land on such farms is laid out in strips varying in width from six to ten rods. These are laid out on contours along the side of the hills in such a way as to carry the water very gradually to the

lower levels. Tillage operations are conducted, following the contours along the side of the hill instead of up and down the hill. Deep furrows may mark the divisions between the strips serving at the same time to stop the flow of water in direct line down the hill. Where the land will permit, it is possible to lay out strips that are fairly equal in size and adapted to crop rotation purposes. To illustrate the advantages of strip cropping and the possibilities as well, reference is made to Plate IX, with its accompanying explanation of the objectives of strip cropping.

Strip cropping is also practiced in areas where wind erosion is prevalent to prevent soil drifting. The custom is to provide a dense, tall growing crop to stop the wind from carrying soil particles across the field. Strips of the sorghums, or Sudan grass, or other crops of similar growth habit, sown at intervals of 6 to 12 or 15 rods, will effectively slow down the drifting and prevent serious damage to small-grain crops. Fall-sown rye or other winter grain can be used in some areas to protect spring-sown grains.

TERRACING. Leveling the land into terraces along the side of a hill is sometimes employed in preparing land for cropping where erosion is troublesome. It is a common practice on the cotton lands of the southeastern states. By means of a road grader or with heavy scrapers the steep banks on the lower side are raised by moving dirt from the upper side. The terraces are laid out on contour lines along the side of the slope and graded to carry the water to lower levels at a rate so slow as to cause but little damage. The banks of the terraces are seeded to grass or other vegetation and left undisturbed by tillage. Crops are then grown on the nearly level land following the contour lines.

A more modern type of terrace, known as the Mangum Terrace, is built on a broader base with rounding shoulders and no banks. It is quite as effective in controlling the flow of water as the bank terrace. Its chief advantage lies in the greater ease with which the field can be worked. The absence of high banks and waste land makes it possible to use all the land. The broad round-shouldered terraces permit crossing with implements and offer but little interference to the usual farm operations. This form of terrace is used on the larger farms of the Great Plains and of the Corn Belt.

Simple conservation practices can often be applied to a field or a farm without extensive planning or great expense. Many farms, however, lie in a watershed. A plan, therefore, must be made for the whole area or district. In such cases the services of

a competent engineer should be employed to develop the plan for the district and for each farm in the district. These plans are likely to be complicated and must take many items into consideration.

An illustration of how such a plan can be worked out is given at the end of this chapter.

SEED-BED PREPARATION

The initial point in producing a good crop is the seed bed. Some crops do best on an open, mellow seed bed, others on one that is firm and compact. Some seeds should be deeply planted; others germinate best where but lightly covered with soil. Seeds may safely be more deeply planted in a warm, mellow loam soil than in cold, dense clay soil. A farm operator must know not only the soil of his farm, but also the nature of the seed he sows and of the crops to be raised from it. The preparation of the seed bed for each special crop should be given careful thought and attention. Only the general principles common to all crops will be discussed here.

Plowing the Land. Seed-bed preparation usually begins with plowing the land. The primary reason for plowing is to bring up fresh mellow earth to form the base of a new seed bed. A secondary reason is to bury residues from other crops and incorporate organic matter with the soil. Still another reason is to pulverize the soil and open soil particles to the action of air and sunlight. Incidentally, plowing destroys some forms of insect life detrimental to crops. The action of the air and of the organic matter decaying in the soil brings about chemical reactions which more quickly release and make available the elements of nutrition needed by growing plants.

Whether to plow deep or shallow depends on the nature of the soil to be plowed and of the crop to be grown upon it. As a rule, deep-rooted crops require deeper plowing than shallow-rooted ones. Deep plowing is seldom objectionable except where the surface soil is underlaid with an infertile subsoil or where gravel or other material not suitable for a seed bed would be brought to the surface by it. Deep plowing requires more power than shallow plowing and is consequently somewhat more expensive. For most crops, plowing at a medium depth meets all requirements and will prove satisfactory. Plowing at a depth that will permit turning a good furrow and burying the crop residues and trash found on the land is a good rule to follow. Land that

has been under cultivation for a long time usually requires deeper plowing than new prairie land or meadow and pasture land when again put under the plow.

When to plow is also a matter of some importance. Again the answer depends on the land and the crop to a large extent. In the Corn Belt and in the greater part of the hay and dairy region, fall plowing is favored in preparing for the cereal crops. For the winter grains it is a necessity. Usually, early fall plowing gives the best results. There are several reasons for this practice. In the first place, turning the furrow slice breaks the capillary connections through which moisture moves to the surface. Early plowing gives time for the soil to settle and again set up capillary action. Fall rains are more readily absorbed into the newly plowed land and are a factor, too, in again compacting the land and restoring capillary action. On land so plowed only shallow surface tillage is needed in the spring to prepare the seed bed for the crop. Earlier seeding is permitted than where the land must first be plowed. Early seeding, it should be remembered, gives the best yields from most crops.

In areas where rainfall is limited spring plowing is preferred. In that part of the Great Plains area devoted to spring-sown cereals, very little fall plowing is done. The standing stubble from the previous crop serves to hold the snow, which, in melting, supplies moisture to the soil. Spring plowing is followed by immediate seeding on the theory that the moisture from the melting snow and frost will be sufficient to germinate the seed and support the early growth. The soil, open and porous from the plowing, readily absorbs the rainfall when and if it comes, thus supplying moisture to the growing crop. No specific rules can be given to govern the depth or the time to plow. Observance of the principles discussed above, however, will give reasonable insurance for successful crop production.

Other Tillage Operations. Most cereal crops do best on a firm, compact seed bed. Shallow surface tillage is, therefore, the best spring preparation on fall-plowed land. The disk harrow, spring-tooth, and duck-foot cultivator, each serves a useful purpose in loosening the surface, pulverizing the soil, and killing weeds that may have started. Such cultivation does not disturb the soil capillaries nor dry the soil to a harmful degree. Loose, open soils may be firmed by the use of so-called subsurface packers, which pack the lower part of the furrow slice and leave the surface free and loose for covering the seed grain. Packing the

soil after the seed is sown improves the moisture conditions, brings the seed in closer contact with the soil, and often hastens germination and growth in a dry, loose seed bed.

Under some conditions the best results are obtained without plowing the land before cropping. In the spring-grain areas, for instance, cereal crops usually follow corn or other cultivated crops in the rotation. On land that has been given clean cultivation the previous year and is free from weeds and trash, preparation of the land may be made by disking to a depth of two to three inches. Double disking may be necessary on corn land. Such treatment does not disturb the soil moisture so much as plowing and is less expensive. In a series of rotation plots at the Minnesota Experiment Station, where cereals are grown on corn land prepared in this way, yields are equal to or exceed those of the same crops grown on fall or spring-plowed land. Since economy of operation is a large factor in making profits from crop growing, the good operator will take advantage of all opportunities to reduce expense.

CROP ROTATION AND MANAGEMENT

Much can be done to keep the soil in good condition by the establishment of crop rotations suited to the needs of the farm. The continued growth of the same crop on a piece of land over a period of years is likely to lead to bad results. Weeds and plant diseases follow continuous cropping to grain. Erosion and soil depletion are likely to follow continuous use of land for cultivated crops. This result is especially sure where crops are grown on land of uneven contour. Land held in grass continuously will eventually decline in yield unless improved by dressings of manure or commercial fertilizers. These dangers can be greatly lessened by combining the three classes of crops in a well-balanced crop-rotation system.

Crop rotation in common terms means only a proper classification of crops and systematic and regular change in the order of growing them. In arranging the crops in rotation, however, special attention should be given to providing crops which will restore the organic matter in the soil. The legume crops are especially desirable. They not only supply a large amount of leaf and root growth, but the material is highly nitrogenous and improves the soil more than organic matter from other crops.

Farm Crops Classified. Farm crops may be roughly classified for rotation purposes into three groups for the purpose of arrang-

ing crop rotation. These are (1) grain crops, (2) grass crops, and (3) cultivated crops.

The grain crops include wheat, oats, barley, flax, rye, and such other cereals as may be grown for mature grain. The roots of all these crops are shallow and feed near the surface. A part of the plants, the stubble, or other crop residue, is returned to the soil. This class of crops may be said to be neutral so far as the destruction of vegetable matter in the soil is concerned.

The grass crops include the true grasses, such as timothy, redtop, bluegrass, brome, orchard grass, rye grass, and others. Included with these grasses for meadow and pasture purposes, many of the legumes are used. The clovers, alfalfa, cowpeas, soybeans and others belonging to the legume family are widely grown. These plants produce a large number of leaves, many of which are broken off and returned to the soil. The roots of the clovers and alfalfa penetrate deeply and aid materially in aerating the soil. The crowns and roots of these plants are large and, when plowed under or allowed to decay in the soil, add considerable organic matter. The grass crops are useful also in keeping down weeds and in encouraging the production of livestock, thus providing manures for the land. The grass crops are particularly useful to increase the organic matter in the soil.

The cultivated crops, such as corn, cotton, potatoes, and root crops of all kinds, form the third group. While looked upon as soil-building crops and usually grown for the purpose of cleaning the fields of weeds, they are, as a matter of fact, more exhaustive of soil fertility than grain or grass crops. The frequent cultivation in tilling the crops breaks down the organic matter rapidly. The destruction of organic matter renders the soil hard and compact. Air does not enter readily and moisture conditions are not as good as in the soil that contains a large amount of decaying plant matter. Conditions in such a soil are not favorable to bacterial life, which is essential in the formation of plant food. The roots of the cultivated crops supply little or no organic matter and the frequent cultivation hastens the destruction of plant material already in the soil. Land used for tilled crops only, usually gets in bad physical condition. Cultivated crops are very destructive of organic matter.

Harmful results will follow continuous production of any of these groups of crops without change. Change of crop within the group should not be considered as crop rotation. A succession of wheat, oats, barley, and flax, is better than growing any

one of them continuously. It should be considered only as a change of crop and not a true crop rotation. The growth of timothy and clover, followed by timothy raising for a number of years would not be rotation, though it is a kind of farming frequently practiced, especially in the eastern states. Any scheme of cropping which provides for a systematic rotation of crops included in the three groups would be a true crop rotation. Grain, either wheat, oats, barley, or some other cereal, followed by grass, such as timothy, or a mixture of some of the grasses with legumes for one or two years and that followed by a cultivated crop, such as corn or potatoes, gives not only a change of crops but a change in classes of crops and is a suggestion of ideal crop rotation.

Rotation of Crops Not Difficult. In arranging rotations it is only necessary that the three groups of crops be included and that the effect of each group upon the soil and upon the crops which are to alternate with it be considered. Grain fields may be divided, sowing wheat on one portion, oats on another, and flax on a third part. The effect of all these crops on the land is practically the same and all may be regarded as grain crops. Frequently only a small amount of one of the cultivated crops will be desired. It is possible to plant a field to corn, potatoes, and mangels or other root crop. Part of the field may be put into corn and the rest occupied by potatoes, sugar beets, or, in the South, cotton. Each of the cultivated crops has approximately the same effect on the land. The cultivated crops, at the same time, offer opportunities for exterminating weeds and cleaning up the land. Part of the grassland can be used for meadow, if desired; the balance, for pasture. Some of it may be in one mixture of grasses for hay-making purposes; the other, in a mixture more suitable for pasture.

The management of a farm under crop rotation becomes more or less automatic. It, therefore, offers fewer perplexing problems than the management of a farm which has irregular fields and no systematic method of cropping. Where two rotation cycles are followed on the same farm, the cropping becomes more flexible than where only one is used. In this case a change of crops can be made within rotations frequently, and it will be possible to meet market fluctuations, seasonal disturbances, or changed labor conditions.

It is important in planning a rotation system that provision be made to have all fields well drained and put in good working

condition. Rough or broken land may well be used for permanent pasture. Such land in a rotation field is not only difficult to work but expensive. Short rows, frequent turning, and irregular shape, increase the expense of tillage. So far as possible the fields should be uniform in size and regular in boundaries. There should be a field for each year in the rotation.

TABLE XI—COMPARISONS AMONG CROPS ON THE BASIS OF TOTAL VALUE OF PRODUCT PER ACRE AND TOTAL NUTRIENTS PRODUCED PER ACRE, WASECA STATION, 1921-1942[1]

Crop	Bushels per Acre	Price per Bu.	Value per Acre	Pounds per Acre	Digestible Nutrients	
					Protein Pounds	Total Pounds
Rye	36.7	$0.58	$21.29	2055	212	1646
Oats	71.1	.30	21.33	2275	214	1627
Spring wheat	24.3	.92	22.36	1458	169	1225
Barley	50.9	.48	24.43	2443	227	1923
Durum wheat	27.8	.89	24.74	1668	193	1401
Soybeans	19.7	1.28	25.22	1182	388	1019
Winter wheat	29.2	.91	26.57	1752	203	1472
Flax	18.2	1.79	32.58	1019	218	1108
Corn	64.7	.53	34.29	3623	264	2989

SELECTION OF CROPS FOR THE ROTATION. The general factors that determine the adaptation of crops to an area have been discussed in Chapter V. Not all crops that are adapted to an area are equally profitable on all farms within the area. The individual farmer should choose those crops that will contribute most to the earnings of his particular farm. Some of the factors to be considered in choosing between different crops are:

1. Gross production per acre in physical or value units.
2. Net product per acre.
3. Return per hour of labor from each crop.
4. Cost per unit of physical product.
5. Labor supply of farm and labor demands of crops.
6. Competing, complementary, and supplementary relationships among different crops.

An illustration of using gross production per acre as a basis for comparing crops is shown in Table XI. The comparison on the basis of gross value per acre is quite significant for the small grain crops which make about the same demands on the farmer's resources and for which the costs of production per acre are very nearly the same. These comparisons are based on historical yields

[1] Data from *Bulletin 365*, Minnesota Agricultural Experiment Station.

and prices. If it seems probable that either yield or price relationships between crops will change in the future, this must be considered in evaluating differences.

The comparison on the basis of gross value per acre is significant only as these crops are considered as cash crops. Many of them are raised primarily as livestock feed. The quantity and quality of feed production per acre is a more useful basis for selecting feed crops. Total digestible nutrients produced per acre indicate the total feed production, and the pounds of digestible

TABLE XII—COMPARISON OF CROPS ON THE BASIS OF NET RETURN PER ACRE, CHAMPAIGN AND PIATT COUNTIES, 1928-1937[1]

Crop	Gross Value per Acre	Cost per Acre	Net Return per Acre
Alfalfa hay	$24.77	$20.21	$4.56
Corn	23.22	20.01	3.21
Winter wheat	20.72	19.56	1.16
Soybeans	22.60	21.85	.75
Soybean hay	19.55	21.84	—2.29
Oats	12.13	16.03	—3.90
Clover hay	13.93	18.32	—4.39

protein is a measure of quality since protein is the element most likely to be deficient in livestock rations and the most expensive one to purchase. In this particular comparison corn ranks first in both total value per acre and in the production of digestible nutrients per acre. All of the other crops rank differently when compared as feed and cash crops.

The net return per acre is somewhat more significant as a basis for crop selection than the gross return. This method is illustrated in Table XII. The significance of net return is limited as is gross return by the extent to which the prices used reflect future price relationships.

The use of this method is also limited by the fact that few farmers have cost of production data for their farms. For most farmers the only cost of production data available are those obtained from farm management research studies made by agricultural experiment stations. Insofar as these cost data are obtained under conditions similar to those under which the farmer is operating they may be of significance in making a choice of crops in planning his production program.

Another basis for making comparisons between crops that has

[1] Data from *Bulletin 467*, Illinois Agricultural Experiment Station.

long been used is the return per hour of labor.[1] Some comparisons of this type are shown in Table XIII. They are subject to the same limitations mentioned in the previous paragraph. They must also be interpreted in terms of the seasonal distribution of labor demands. A crop for which the labor may be distributed over a considerable period of time and does not conflict seriously with other crops is likely to add more to the farmer's net earnings than one which affords a higher return per hour but conflicts with other enterprises to the extent that the acreage is limited.

TABLE XIII—COMPARISON OF CROPS ON THE BASIS OF RETURN PER HOUR OF MAN LABOR, 1914-1938[2]

Crop	Return per Hour of Man Labor					
	1914–18	1919–23	1924–28	1929–33	1934–38	1914–38
Alfalfa hay	$0.82	$0.94	$0.78	$0.31	$0.53	$0.68
Apples	....	.79	.79	.45	.45	.62
Potatoes	.49	.51	.89	.52	.50	.58
Cabbage	.46	.45	.49	.34	.48	.44
Tomatoes (canning)	....	....	....	.24	.41	.34
Other hay	.73	.66	.08	—.01	.18	.33
Wheat	.58	—.03	.20	—.03	.47	.24
Peas (canning)	....	....	....	.21	.16	.23
Dry beans	.12	.23	—.06	.05	.30	.13
Barley	.03	—.28	.07	—.34	.07	—.09
Oats	.11	—.31	.03	—.34	—.02	—.11

In selecting feed crops, the amount of feed produced per hour of labor and the cost per feed unit are significant measures of comparison. The use of these measures is illustrated in Table XIV. For the area covered by these data more feed nutrients are produced per acre and per hour of labor by corn than by any other grain crop and the cost per unit is the lowest of any of the crops compared. Of the roughages, corn silage produces more digestible feed per acre but the cost per unit is 23% higher, 31% less nutrients are produced per hour of labor, and the protein content is low as compared with alfalfa hay. The application of this type of comparison to a specific farm is illustrated in Table XV. A shift in the choice of crops from the present system to proposed system No. 1 results in a substantial increase in pounds of T.D.N. per acre and per hour and a lower cost per pound. Under the proposed system No. 2 there is a little less increase in total

[1] A. Boss, "The Choice of Crop Enterprises Based on Returns for Labor," *Journal of Farm Economics*, Vol. III, No. 1, January, 1921.
[2] Data from *Cornell Extension Bulletin 439*.

T.D.N. production but an increase per hour of labor and some decrease in the cost per unit.

A suggested form for comparing different cropping systems in terms of feed production is shown in Table XVI. This is designed for comparing the present cropping system with a proposed alternative. By using average or normal yields it is possible

TABLE XIV—COMPARATIVE CROP COSTS AND RETURNS IN SOUTHEASTERN MINNESOTA, 1918-1942[1]

Crop	Yield per Acre	Lbs. Nutrients per Acre		Lbs. T.D.N. per Hour Man Labor	Cost per 100 lbs. T.D.N.
		Protein	Total		
Corn	52 bu.	213	2373	221	$0.71
Barley	30 bu.	141	1117	149	1.32
Oats	43 bu.	141	956	127	1.58
Wheat, winter	20 bu.	105	950	127	1.59
Wheat, spring	17 bu.	90	808	108	1.84
Rye	17 bu.	87	780	104	1.84
Alfalfa hay	2.4 tons	499	2472	225	.66
Corn silage	8.3 tons	199	2789	155	.81

TABLE XV—COMPARATIVE FEED PRODUCTION WITH DIFFERENT CROPPING SYSTEMS[2]

Crop	Cropping System		
	Present Acreage	Proposed Acreage	
		No. 1	No. 2
Oats	35	10	10
Barley	15	15	15
Corn	33	50	50
Alfalfa hay	17	25	17
Alfalfa pasture	....	....	8
Total	100	100	100
Pounds of T.D.N.	170,548	206 765	201,821
Hours of labor	917	1,000	928
T.D.N. per hour of labor	186	207	217
Cost per 100 lbs. of T.D.N.	$0.93	$0.79	$0.77

to compute the feed production in terms of both digestible nutrients and digestible protein for each cropping system. By comparing the totals of columns 6 and 7 and 10 and 11, the relative quantity and quality of feed that each will produce can be determined. This table is set up for a particular area, but the same type of table can be set up for any area by using the crops that are adapted to that locality.

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[1] Data from *Minnesota Extension Pamphlet 133*, January, 1944.
[2] *Op. cit.*

TABLE XVI—A SIMPLE FORM FOR COMPARING CROPPING SYSTEMS IN TERMS OF FEED PRODUCTION[1]

Crop	Yield per acre 1	ACRES OF CROPS: Usual acreage 2	ACRES OF CROPS: Proposed acreage 3	TOTAL DIGESTIBLE NUTRIENTS: Pounds per unit (Bu. or ton) 4	TOTAL DIGESTIBLE NUTRIENTS: Pounds per acre 5	TOTAL DIGESTIBLE NUTRIENTS: Total pounds: Usual acreage 6	TOTAL DIGESTIBLE NUTRIENTS: Total pounds: Proposed acreage 7	DIGESTIBLE PROTEIN: Pounds per unit (Bu. or ton) 8	DIGESTIBLE PROTEIN: Pounds per acre 9	DIGESTIBLE PROTEIN: Total pounds: Usual acreage 10	DIGESTIBLE PROTEIN: Total pounds: Proposed acreage 11
					Col. 1 x Col. 4	Col. 2 x Col. 5	Col. 3 x Col. 5		Col. 1 x Col. 8	Col. 2 x Col. 9	Col. 3 x Col. 9
Corn	____ bu.			46				4.1			
Oats	____ bu.			22				3.3			
Barley	____ bu.			37				4.7			
Winter wheat	____ bu.			48				5.3			
Spring wheat	____ bu.			48				5.3			
Rye	____ bu.			46				5.1			
Alfalfa	____ tons			1030				208.			
Red clover	____ tons			992				148.			
Alsike clover	____ tons			946				158.			
Clover and timothy	____ tons			986				102.			
Timothy hay	____ tons			960				56.			
Soybean hay	____ tons			1000				180.			
Corn silage	____ tons			336				24.			
TOTALS											

NOTES: *Crop Yields.* The comparison of total feed produced from the "usual" and "proposed" acreages referred to in the table is based on the same yields per acre. The use of adapted varieties, the careful use of commercial fertilizer, and better cultural methods may result in materially higher yields. This would increase the total feed production but would not be likely to make much difference in the choice of crops. Corn and alfalfa would, in most cases, still retain their advantage.

Instructions for Using Work Chart. Using average or normal yields per acre, and the usual or normal acreage of each crop, compute the total digestible nutrients produced per acre (column 5) and the total digestible nutrients from the usual acreage (column 6). Then compute the total pounds that would be produced on the proposed acreage (column 7), and compare the totals for the farm.

Compute the protein production in the same way, and compare these totals.

[1] *Op. cit.*

The various suggestions for selecting crops to be included in the rotation that have been discussed in this section all have certain limitations. There is no simple mathematical formula for crop choice. Each of these methods supplements and guides the farmer's judgment in planning his cropping system. Crops must be chosen on the basis of how they fit into the farming system as well as in terms of production or return. Some crops need labor at one season of the year and others at another. It is desirable to select crops in such a way as to distribute the labor demands through the season as uniformly as is possible. A crop that is not otherwise profitable might add materially to the farmer's net income if it provides employment at a time when there would be no productive use for the farm labor supply. All crops compete with each other in their demand for land but they may supplement each other in providing full utilization for labor, power, and machinery. Some crops contribute directly to the production of others and thus are said to complement them. Intertilled crops such as corn serve to clean the land for other crops that follow them and the legumes store nitrogen in the soil for succeeding crops. All of these relationships between crops should be considered in choosing the crops to be included in a rotation plan for a particular farm.

WEED CONTROL MEASURES

Weeds have been defined as plants growing out of place or where not wanted. Most plants that are regarded as weeds may serve some useful purpose. Some of the standard crop plants may have the effect of weeds when growing where not wanted. Sweet clover, one of our most useful pasture crops, was long regarded as a weed. It is still so classed when it voluntarily appears in a grain or flax crop. Weeds can be controlled by good farming. Usually, they appear where nothing else is growing.

Someone has said that nature abhors a vacuum and that weeds only fill in the waste places. Proof of this statement may be observed in many places. Ditches, railway cuts, and erosion gullies offer plenty of evidence. Fresh scars made in construction, left to themselves will heal over in time. In most instances they are soon covered over by grass or other useful crop. Often some plant will take possession of the surface. From a slight hold on the land, it spreads out to cover not only the scar but to become established through scattered seeds or extended roots on any spot not already occupied. Thin, overgrazed pasture lands often be-

come weedy. This is because the spots on which the desirable grasses have dried out or killed off are occupied by yarrow, thistle, burdock, sourdock, or some other persistent pasture weed. Many areas in the Red River Valley and adjacent sections of Minnesota and North Dakota were at one time threatened by the sow thistle. It has been found to yield to good tillage methods and to the full occupation of land with crops of economic value. Canada thistles, which are troublesome over a large area, can be controlled by keeping the land fully seeded to alfalfa for a period of three or four years.

The remedy for weeds in most instances is to keep the land so fully occupied in growing desirable crops that there is no room for the weeds. Another preventive measure is to avoid sowing weed seeds with grain or new grass seedings. All seed grain should be carefully cleaned and inspected before sowing, and recleaned, if necessary. Only the grades of grass seed which are certified as free from noxious weeds should be purchased. Weed control depends upon good farming. It requires constant watchfulness for the appearance of new and dangerous weeds. Prompt action upon discovery of the first plants will often head off what would become a troublesome pest if left undisturbed.

When land is once infested with weeds, control measures will depend much on the nature of the weed and the type of soil and the climatic conditions under which the infestation occurs. In most instances, eradication of noxious weeds begins with thorough, deep plowing at a time when the roots of the plants have been exhausted in the production of leaves and flowers. A period of black fallow then follows during extremely hot weather and quickly decays the plants. Root growth will start again or new plants will spring up from seeds and the fallow must be continued until growth is reduced to a minimum. Following such preparation with either a dense smother crop or with a crop that permits clean tillage, all but the most persistent weeds can be brought under control.

Specialized attacks on noxious weeds will be needed on farms where firmly established. Spraying with sodium chlorate or other similar chemical may be advisable in some instances. Where large areas are infested it often becomes a matter of township and county co-operation to control the weeds.

Those troubled with weeds beyond their control should consult the nearest county agent or the extension service of their agricultural college.

TIMING THE OPERATIONS

Emphasis has already been placed on the importance of correct timing for all farm operations. Additional emphasis may well be given in connection with crop production. A statement has previously been made that fall plowing is desirable for the production of small grain crops. That, however, depends on the farm and its location. Only experience can determine for each farm whether spring or fall-plowing is preferable. Once determined, however, the practice should be followed as closely as possible. Whether to disk or to plow depends on the soil, on the climatic conditions of the region, and the nature of the crop to be grown. It is important, however, that whatever the operation it be performed at a time which will require the least power and bring the best possible returns in results. The important thing in either plowing or disking is to put the seed bed in good tilth and to provide the best moisture conditions in the soil to be cropped.

In all farm operations and in all locations there is a best time and a best way to perform each one. It is impossible to anticipate the operations that are to be required by individual farms in any particular year. That point can best be determined by the one who is to operate the farm. The point to make here is that the habits of the plants and the nature of the soil be known and the tillage and production operations be so timed as to give the highest returns for the least possible expenditure of materials and human energy.

THREE RULES TO FOLLOW

There are three good rules to follow in making cropping plans: (The first is to choose crops well adapted to the soil and climate in which the farm is located. So far as possible the nature of each crop should be given consideration in establishing the cropping system for the farm. The second is to grow crops that are suited to the needs of the family and the livestock or for which there are favorable market outlets. The third is, so far as possible, to devote the farm to the production of crops that return high values in the case of cash crops, or the maximum quantity and quality of feed nutrients in the case of feeding crops. Recognition of these principles in crop production may mean the difference between profitable and unprofitable operation.)

ILLUSTRATION AND DISCUSSION OF A COMPREHENSIVE SOIL CONSERVATION PROGRAM FOR A NORTHERN ILLINOIS FARM [1]

This 153-acre farm is located in northern Illinois, where general livestock farming is assuming increased importance. The soils of this farm, except for five acres, are divided almost equally between two types, Clinton silt loam and Lindley silt loam. Both soil types are brownish yellow-gray silt loams developed on limestone and glacial till, respectively, and the original depth of the A horizon was approximately 10 to 16 inches in both cases. The slopes are undulating to rolling and vary from 2 to 12 per cent. Considerable sheet erosion has taken place; on the majority of the land at least 25 to 50 per cent of the original topsoil layers have been washed away (class 3 erosion). On part of the Clinton silt loam area, erosion has not been so severe, falling within class 2 (not more than 25 per cent of the original top layers of soil removed).

The erosion-control program outlined for this farm calls for approximately 55 per cent of the total land area to be in crops. This percentage of cropland is somewhat lower than is usual in some other parts of Illinois, in Iowa, and in Missouri. The plan, however, establishes an immediate program and one that will give assurance of the future fertility maintenance of comparable farms with gently rolling to undulating topography, erodible soils, and some appreciable soil losses to date.

In addition to serving in the capacity of erosion-control vegetation, many matured woody plants have definite importance in the farm economy. Field 1a (2 acres) will be retired from pasture to woodland and managed for future woodland purposes. This arrangement will provide adequate treatment for this small area, which has a relatively steep slope and has been severely damaged by erosion. A properly managed woodland will produce fence posts, lumber for repair of buildings, and other timber products, and will serve as a habitat for wildlife.

Forty-two rods of woven wire, 126 rods of barbed wire, and 50 fence posts will be used for construction of the fence necessary to protect this area from grazing. About 2,500 mixed hardwood seedlings will be set out in this 2-acre area.

RETIREMENT OF ERODED CROPLAND TO PERMANENT PASTURE

It is desirable in many cases to retire certain croplands that have eroded to an appreciable degree. Field 1b (57 acres) is designated for permanent pasture. Approximately 17 acres of this field will be retired from crops and seeded with a pasture-grass mixture. Oats will be used as the nurse crop. The old boundary fences will not be removed until the new pasture is ready for use. The following commodities and materials are necessary for use on this field: 50 bushels of oats (nurse crop), 425 pounds of mixed grass seed, 75 tons of agricultural limestone (to be used on new pasture areas), 300 fence posts, 220 rods of woven-wire fencing, and 660 rods of barbed wire. Special attention will be given to the development of a good grass water-

[1] From *Yearbook*, U.S.D.A., 1938, pp. 674-76.

way at the north end of this pasture, where water comes from fields 2e and 4a and from the adjoining road ditch.

Seven acres of this pasture, in the southwest part, will be contour furrowed to aid in holding more moisture, to obstruct surface run-off, and to reduce soil losses from erosion.

PASTURE IMPROVEMENT WHERE OVERGRAZED. Even permanent pastures are not free from erosion, especially where they have been improperly handled. Field 3 (8 acres) will continue in permanent pasture. This area has been overgrazed in the past and damaged somewhat by erosion along a draw in the middle. An application of 25 tons of agricultural limestone will be applied to aid in producing a heavier sod and to increase the carrying capacity of the pasture. Four tons of ground rock phosphate will also be applied to aid in rejuvenation of the pasture grasses.

STRIP CROPPING AND TERRACES

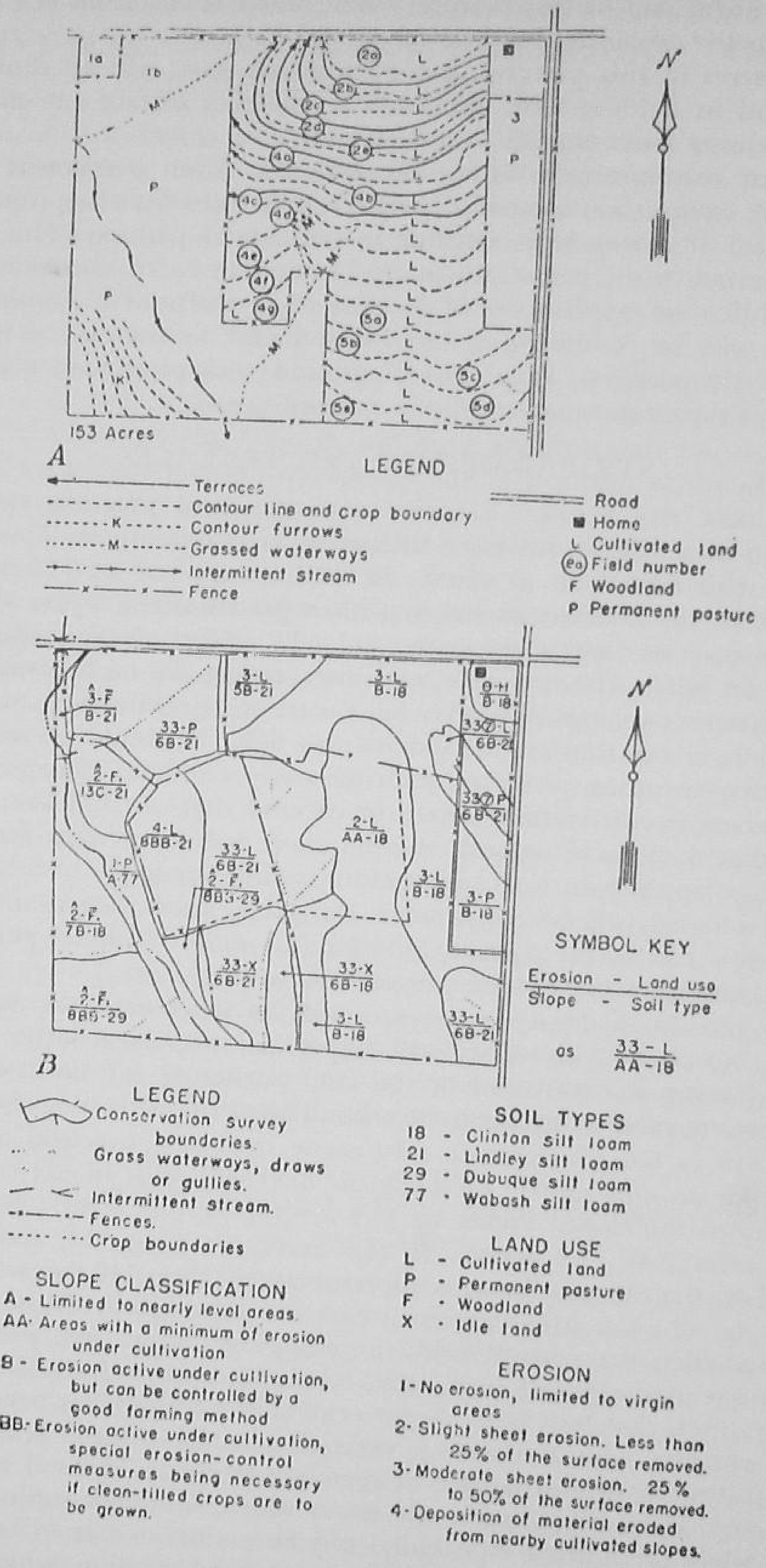
TO BREAK THE SLOPE. Effective erosion-control practices and devices can be used that will not interfere with usual farm operations. Fields 2a (3.6 acres), 2b (3.9 acres), 2c (4 acres), 2d (4.2 acres), and 2e (4.3 acres) will be farmed on the contour in strips, with a predominant 5-year rotation of corn, oats (hay seeding), hay, corn, and oats (sweet clover seeding). The strips will be 100 to 120 feet wide, and the rotation will be followed for each strip, so that no two adjacent strips have corn on them the same year.

The longer rotation established for this field will build up soil fertility, and the strip-cropping practices, with alternate bands of close-growing and clean-tilled crops, will retard water run-off and decrease soil loss. Soil tests indicate that 60 tons of agricultural limestone will be needed for the field. Lime will be applied on each strip before seeding for hay.

A new fence will be constructed along the north side of this field to permit easy access to the pasture, field 1b, for which 130 fence posts, 96 rods of woven wire, and 288 rods of barbed wire will be needed.

Four broad-base Mangum terraces will be constructed in this field, in strips 2b, 2c, 2d, and 2e. They will empty into a grassed outlet which will be seeded along the west end of the land bordering the north side of the field. These terraces will reduce run-off and assist in controlling sheet erosion.

TO AID IN GULLY CONTROL. In many instances, practices and devices designed for erosion control on a specific field will assist in soil conservation farther down the slope. Fields 4a (6.5 acres), 4b (6.8 acres), 4c (7 acres), 4d (6.9 acres), 4e (7.3 acres), 4f (6.3 acres), and 4g (1.9 acres) will be operated on the contour in strips approximately 110 to 140 feet wide. Except for strip 4g, which is irregular because of the draw which will be fenced out and included in the pasture field, the cropping pattern will predominately follow a 6-year rotation of corn, corn, oats, and 3 years of alfalfa. This field is nearly level, and less than 25 per cent of the topsoil has been removed; but the rotation with 2 successive years of corn following 3 years of alfalfa can be followed without danger of speeding erosion. The soil type on this field is predominantly Clinton silt loam, which, although subject to severe erosion when clean-tilled repeatedly, can be maintained from both a structural and fertility standpoint by following a good rotation, which will help keep up the organic content of the soil, and by utilizing practices which will prevent rapid water run-off.



A. Land-use map of the representative Corn Belt farm, illustrating erosion-control in the Midwest.

B. Conservation survey and soil map of the farm.

Three broad base Mangum terraces will be constructed on the upper part of this field in strips 4a, 4b, and 4c. These terraces will empty into the pasture field 1b. They will be constructed after the new seeding of pasture grass is well established on the east side of field 1b, where some cropland is to be retired. This disposal of excess run-off will reduce the quantity of water going through the draw and potential gully which enters field 1b at at the east end of strip 4g. Vegetation, therefore, will be sufficient protection for the soil in this draw, and no structural work will be necessary.

WIDER STRIPS AND SHORTER ROTATIONS ON MORE NEARLY LEVEL AREAS

Erosion control recommendations are made for different fields according to the seriousness of the problem involved. If erosion is not very serious, then the practices to be followed are not so rigid. Fields 5a (2.6 acres), 5b (4.4 acres), 5d (4.8 acres), and 5e (4.4 acres) will be worked as contour strips approximately 120 to 150 feet in width. Fourteen tons of agricultural limestone will be necessary on strips 5b and 5d, the first year of the rotation, since they are to be seeded to clover. A similar application will be made on each of the other strips before seeding them to clover later in the rotation. The rotation on this field may be shorter and include a higher percentage of clean-tilled crops, since it is almost level and past treatment has left it in a relatively high state of fertility. The rotation will be corn, oats (sweet clover), corn, oats, and hay.

GENERAL COMMENT

The established crop rotations will permit approximately 37 per cent of the cropland to be in corn each year, 33 per cent in grain, and 30 per cent in hay. For some of the strips directly affected by terraces, it may be possible to use a shorter rotation and increase the clean-tilled crops somewhat. With more emphasis on soil fertility maintenance and the enlargement of livestock enterprises, it is improbable that this farmer would need to reduce his proportion of hay and grains. From a long-time point of view, prices, regional shifts in emphasis on different enterprises, and other economic factors will guide him in amending his program.

CHAPTER X

THE PLACE OF LIVESTOCK IN FARM ORGANIZATION

Animals of one kind or another are found on nearly every farm. It is reasonable to suppose that each class of animal raised fulfills some function useful to the operator. In some cases the function is to furnish amusement and entertainment for the family. In others it is to contribute directly to the farm income. Dogs and cats are sometimes kept as playmates for the children of the family. Dogs are useful also in assisting with the care of livestock or in guarding it. Hunting dogs are much used in recreational excursions through the fields, forests, and swamps for game birds and animals. No direct income is expected or earned from the use of such animals.

Horses or mules are kept on most farms for their usefulness in furnishing power for farm operations. Horses are kept by some farmers, however, and by many others who are not farmers, for the pleasure gained from driving, riding, polo playing, or hunting. For these latter functions no direct income is returned. One may be justified in keeping dogs for hunting and horses for riding where the expense can be afforded without limiting the funds needed for family living expenses. In such cases the operator may truly be said to be keeping the animals, that is, contributing to their support without expectation of financial reward. As sources of power, for which they are used on most farms, horses and mules contribute directly to the farm income when wisely used. In such cases they may be said to be keeping the farmer. That is, they are contributing to the support of the farmer and his family. To add net income to the farm operator is the major reason for producing livestock. The income arises from different sources with the various classes of livestock, but the objective is the same, support for the farm operator and his family.

That livestock produced is an important enterprise in farming is indicated by the fact that nearly two-thirds of the income from the farms of the United States is from the sale of livestock

Plate XIII. Cattle on the short-grass plains

Large herds of beef-bred cattle convert the rich short-grass of the plains into salable food products at low cost. Courtesy G. N. Railway.

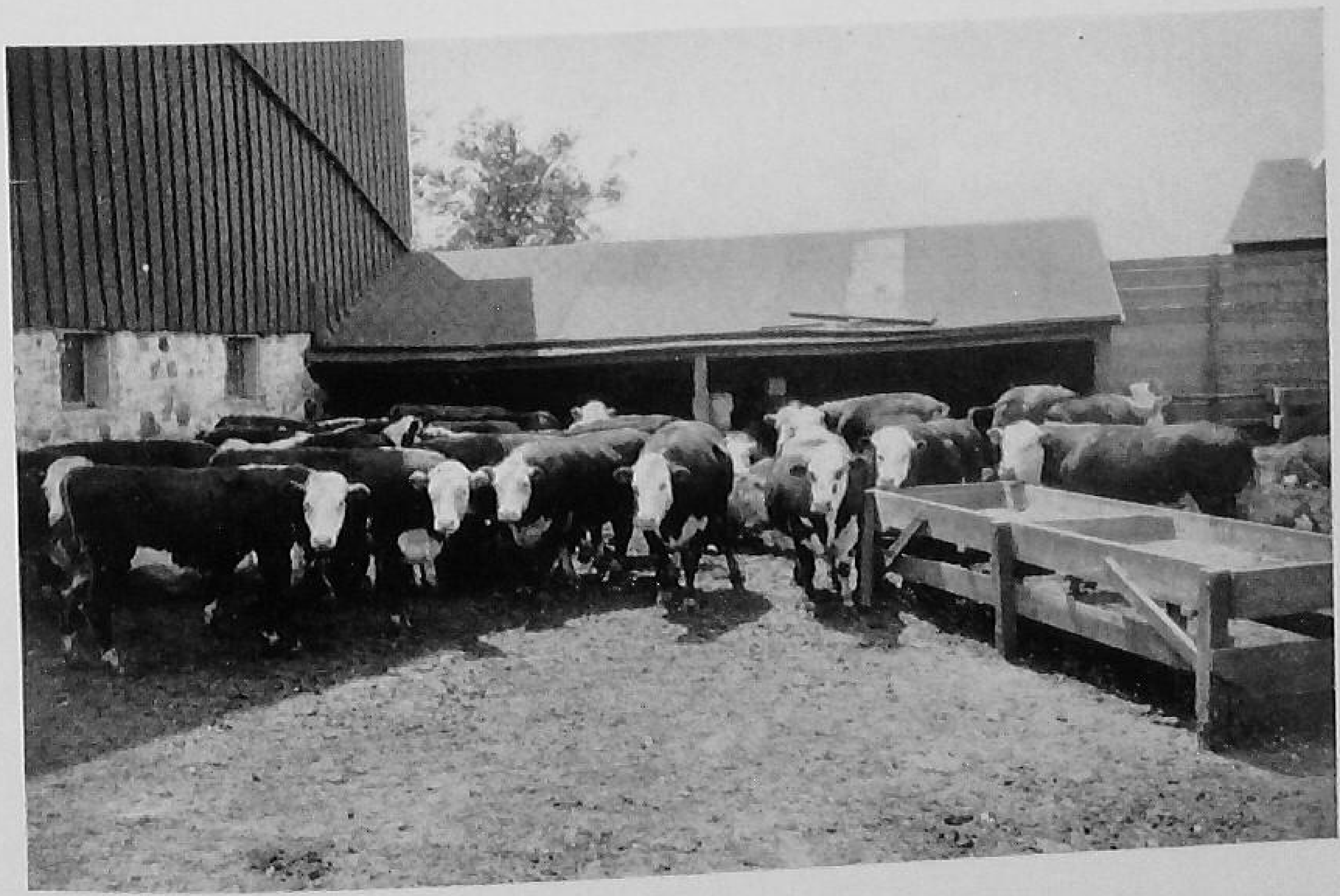


Plate XIV. Beef cattle in the feed yard

Many cattle from the ranges are brought to the feed yards to be fattened for the market on corn and other grains. Courtesy F. C. A., St. Paul.

PLATE XV. A RANCH SUBSTATION

Roughage supplies, corrals, and temporary shelters are a safeguard against winter storms on the ranges. Courtesy G. N. Railway.

PLATE XVI. FAT CATTLE AT A TERMINAL MARKET

At the terminal market the animals are fed, watered, and sorted in preparation for sale. Buyers then visit the pens and make offers to buy. When a sale is made, the animals are driven to the scales, weighed, and charged to the buyer.

and livestock products. A careful study of the problem of making profits from livestock production will be of value in gaining an understanding of the place of livestock in the operation of a farm.

HOW LIVESTOCK EARNS INCOME FOR THE FARMER

As previously has been pointed out, each class of animals must perform some service of economic value or yield products that are usable by the farm family or that have ready sale value. This fitting of livestock into the farm program may be accomplished in a variety of ways.

The chief functions of livestock in farming are (1) to convert feeds into foods; (2) to condense bulky feeds into more concentrated form for shipment and sale; (3) to convert into usable or salable form materials that otherwise would be wasted; (4) to more fully employ the resources of the farm; (5) to increase the frequency of sales and of income; (6) to provide a variety of foods for the farm family; and (7) to help in maintaining soil fertility. The manner in which these functions are performed will be clarified in the discussion following.

Converting Feeds into Foods. Farming is based on crop production. The soil and climatic conditions of an area or a locality determine what crops can be raised safely and with satisfactory yields and results. Since farm animals live almost entirely on plant life, the kind and quantity of crops that can be grown in an area or on a farm determines the classes of animals that can be economically produced in that environment. Some crops are produced as human-food crops, others as feed for animals. Potatoes, vegetables, fruits, and, to a large extent, wheat and rice are examples of food crops that can be used by man without conversion into other forms by animals.

Grass and forage crops can not be used in a natural form as human food. They must first be converted into milk or meat or some other form, such as wool or leather, before they are useful to mankind. Corn and cereal grains can be used directly as human foods, but the nutrients contained in them are much more acceptable when converted into milk and meat.

Only about one fifth of the land surface of the United States is used in crop production. The balance is in grass, forest, and waste lands, and land used for social purposes. Of the land used for the production of crops only a small portion is used for the production of food crops. The balance is used for the production

of rank-growing forage crops and coarse grains used in the support of animals. These feed crops are converted into foods and other usable materials by dairy cows, beef cattle, swine, and sheep. They are also used in the support of horses, which are generally kept for the purpose of furnishing power.

To Convert Feed into Concentrated Form. Bulky feeds are often grown at long distances from central or terminal markets. Transportation charges on such products are high in proportion to their sale value. It is important that these products be condensed into more concentrated form as a means of getting them to the market at less expense. Converted into meat by feeding to animals, the value is expressed in salable meat products which can be transported at less cost and return greater value. Converted into butterfat, cheese, or some other form of dairy product, the net energy of the feed crops can be transported economically for long distances. Other examples might be given, but these are sufficient to illustrate the value of livestock for this purpose.

Livestock Converts Unsalable into Salable Products. Approximately one third of the land surface in the United States is in pasture crops, that is, grasses of one kind or another. Grass is the natural feed for livestock. There is no market for a grass, as such. It has use and value only when pastured by productive animals or when grown to maturity and converted into hay, which is used as livestock feed. A large part of the cropland is in rank-growing forage crops. These crops are converted into hay, cured forage, or some other form of fodder. The only outlets for such products are through the medium of some class of animals that can convert them into usable products. Following the removal of grain crops, volunteer growth, which has feed value, will often spring up, but can be utilized only if there is livestock to pasture it off. It can be left to stand and be returned to the soil as organic matter when the land is plowed; but, in that case, it yields no income to the farmer. If pastured off by dairy cows or sheep, it will return income to the farmer and the land will not be seriously depleted by the animals' pasturing upon it. Aftermath grows also in the meadows after the hay crop is removed. This material also would be waste or returned to the soil, were it not used by some class of animals that can convert it into a form usable for human beings.

By-products of the grain fields have little direct value. Straw

from the grain crops, corn stover left after the corn is husked, screenings from the grains to be sold or from seed grain are examples of these by-products. There are by-products of the flour mills and of factories also from which economic returns can be secured only through their use as feed for livestock. Bran and shorts from the flour mills, linseed-oil cake and soybean cake from the oil mills, cottonseed meal from the cotton mills are familiar examples of these by-products. They are all high in nitrogenous content and are useful complements to the coarse grains in forming suitable feeding rations for dairy cows, hogs, or other animals. Most of these would be waste products, were animals not able to convert them into human-food products.

Corn, oats, barley, the sorghum grains, and other coarse feeds are usually salable but at such low values as to make them unprofitable crops. In the long run these crops will bring larger returns to the farmer if marketed through some class of animals. It is here that the farm operator must exercise good judgment. When grain values are high and prices for animals are low, such grains may often be fed at an economic loss. At other times, when the relation of livestock prices to feed prices is favorable, they may be profitably fed. Only by watching the market closely and by efficient feeding can profits be made from feeding readily salable grains to livestock. It must be remembered, however, that livestock is the natural outlet and a most profitable one in most instances. While there are regions that raise coarse grains for cash sale regularly, these grains ordinarily are transported only short distances to where they may be fed to livestock.

On many farms there is some form of waste land. It may be rough, stony, side hills that are free from trees or other growth, but on which grass grows readily. Land that is untillable because of stumps, stones, or other impediments may produce good grass pasture. Low land, too wet to work satisfactorily, may often be made to yield a return to the farm by putting it into reed canary grass, redtop, or other crops adapted to it and it can be made into hay or pastured. No returns could be made from such land except through the medium of livestock.

Profits from livestock growing are most consistently made from the use of low-cost feeds. The foundation for such production lies in good grass and legume pastures. These furnish the natural and lowest-cost feed for the classes of animals known as ruminants, that is, cattle and sheep. It is also a satisfactory feed

for growing colts or for horses that are not employed in heavy work. Good pastures supported by ample supplies of high-quality cured forage lay the groundwork for economic livestock production. For finishing meat animals for the market low-cost coarse grain crops are essential. These, supported by products of the mills and balanced with a minimum quantity of the high-cost concentrates, offer the most certain avenue for profits from livestock raising. It should be borne in mind that the one who feeds salable grain to livestock is in competition with those who raise their stock on grass, corn fodder, and other cheap waste products of the farm. To compete successfully, the quality of the product must be higher or more must be produced for the same value in feed. For this reason those who feed large numbers of animals on high-priced grain usually raise purebred stock, which has a breeding value as well as a market value for the products produced. If a high-cost ration is fed, a high-valued product must be returned or loss will be experienced.

LIVESTOCK MORE FULLY EMPLOYS RESOURCES OF THE FARM. Profits from farming are made by growing usable and salable crops and by producing or making commodities that have market values. The more of these commodities that can be produced on a given farm, the greater the net returns become, if good management is used. For good returns the farm should be operated under a well-rounded program that will utilize not only all the land but all the other resources of the farm and give productive employment to all available labor. On most crop farms some land can not be used for tilled crops. Livestock can be pastured on it, thus utilizing this resource. Crop farming seldom gives full-time employment the year around for the labor of the farmer and his family or for such help as he may employ. There is time to spare between seedtime and harvest. Productive employment on a farm devoted to raising crops is seldom found during the winter months. The children of the family must be supported whether employed or not, but there is little employment for them during spare time in the summer or during the winter months. Should the farm be supplied with a reasonable number of dairy cows or with beef cattle and hogs or some other form of livestock, there would be employment for the available labor during the times when it would not be needed to care for the crops.

Livestock may increase the volume of business done by the farm in many other ways. It does not follow that livestock added

to a crop farm will always increase the income from the farm. Much depends on the efficiency of the management. It is estimated that the feed cost of dairy cows and poultry is about 50 per cent of the total cost, the other 50 per cent is made up in labor, equipment, and overhead cost. In hog raising and in sheep raising, on the other hand, feed costs run 75 per cent to 85 per cent of the total cost, with labor forming a much smaller proportion. The kind of livestock raised, therefore, should be fitted to the type of labor available and to the number of people that the farm supports, whether employed or not.

The full utilization of the resources and a large volume of business is considered desirable, because it reduces the fixed overhead costs. Interest charges, taxes on real estate, and other fixed expenses will be but little larger for the farmer who keeps livestock. More complete use of the buildings and more constant employment of labor on productive livestock enterprises during spare hours will increase the income from the buildings and equipment and the net income to the farm.

Usually it is desirable to keep more than one class of animals, because it is not otherwise possible to utilize all the resources. Dairy cows and hogs will go well together because the hogs supplement the cows in utilizing the resources of the farm. Where butterfat is sold, skimmed milk, which may be used for hog or poultry feed, becomes available. The common experience, therefore, is to find that both hogs and poultry are kept in some numbers on farms that specialize in dairying. Dairy cows require much labor. Hogs add but little to the labor load. They are, therefore, said not to compete for the labor but to supplement each other in the provision of salable products and feed supplies. Dairy cows make the cheapest products on coarse feeds and forage, with a limited quantity of concentrates. Swine, on the other hand, use but little of the coarse feeds and forage and live largely on concentrates. The dairy cows utilize the pastures and coarse feeds. Swine utilize the skimmed milk and the grain by-products in the production of salable food products. The use of both on a farm not only increases the volume of the business, but under good management gives larger net returns.

Fattening cattle, likewise, are adapted to the use of pasture lands and coarse forage crops. When supplemented by swine and sheep, they offer full year-round employment, with the swine living, to a large extent, on the waste products from the feed

bunks and feed yards. In supplementing cattle, sheep eat the coarser particles left in the feed racks and act as scavengers in cleaning up what would otherwise be waste material.

Increase the Frequency of Sales and Income. In most kinds of crop production, there is only one harvest annually. The income is likely, therefore, to be concentrated into a short period or a single sale. That usually means a feast and a famine for the farm family. Income spread out through the year is more likely to lead to reasonable expenditures and better living. With some forms of livestock, such as beef cattle, there may not be much improvement in the continuity of income throughout the year. With other classes of livestock, such as dairy cows or poultry, income is returned at frequent periods and regularly. While crops are seasonal in production and sales dates may be infrequent, livestock operations can be planned so as to bring sales dates reasonably close together. Some farmers have made it their aim to have a sales day at least once a week. Others are satisfied with a monthly pay day. This plan can easily be accomplished where the livestock program is well planned and the farm organized to support the plans for livestock production. Emphasis may be given to one class of livestock when price prospects are favorable for the production from that class or they may be minimized, when unfavorable. In the long run, however, it pays best to organize definitely for the production of certain kinds of livestock that offer reasonably frequent pay days and stick to that type until some better plan of production can be devised.

To Provide a Variety of Foods for the Farm Family. Farm families, living on farms that produce crops only, are likely to have a limited diet, at least for a good part of the year. The addition of a few cows, some poultry, and at least swine enough to supply the meat needed by the family, will give not only variety to the diet, but will supply nutrients not readily available in the crops produced. Even though a good garden supplements the crop farm, some of the animal products, such as milk, butterfat, and nitrogenous substances of the meats are essential to health and greatly improve the living conditions of the family. Surplus products, arising from these enterprises, if any, will find ready sale in near-by markets at some price.

To Help Maintain Soil Fertility. The opinion commonly prevails that livestock raising helps to maintain the fertility of the soil. This opinion is true only under certain conditions. It is

estimated that an oats crop yielding 50 bushels an acre will require from the soil 50 pounds of nitrogen, 18 pounds of phosphoric acid, and 45 pounds of potash, besides small quantities of several other elements. If the grain is sold and the straw is burned, the entire quantity may be truly said to be removed from the soil. If the grain is fed to cows, the milk and butterfat sold, and the straw used for bedding, but the manure allowed to remain in the yard or barn, just as much fertility is removed from the land as though the crop was sold and the straw burned. If, however, in feeding the grain and using the straw for feeding, care is taken to save all the manure and later to return it to the fields from which the crop came, there would be little loss of fertility. It is very difficult to prevent some loss through decomposition, evaporation, or leaching. There may also be more or fewer losses from mechanical sources. The losses will depend upon the methods employed in getting the manure to the field. The loss from all these sources varies from 40 to 60 per cent. About three fourths of the fertility contained in the feed is removed in the manure as it comes from the animal. This may all be returned to the field where leaching and mechanical losses are prevented. On most farms nearly one half of the fertilizing value contained in the feed is lost before the manure is returned to the field.

The animals through which feeds pass add nothing to the fertilizing qualities of the manure. The crops returned directly to the field upon which they grow would quite as well maintain the fertility of the soil. In the case of the growth of certain of the crops, such as clover and alfalfa, the fertility may even be increased through the addition of nitrogen which these plants have the power to gather from the air in the soil. That use of the crops, however, would not be an economic one.

Mastication and digestion of the foodstuffs by animals render available more quickly the fertilizing elements of the plants. This readier availability of the elements accounts for the belief that the process of mastication and digestion has added to the fertilizing value of the feed materials. Animal manures, without question, are one of the best possible sources for maintaining soil fertility, but the farmer should recognize the fact that, to get their full value, he must prevent all mechanical and chemical losses and that the manures must be distributed evenly over the farm and incorporated with the soil.

The best way of conserving all the fertilizing elements of the manure is to haul it from the barns as made directly to the

fields and incorporate it at once with the soil. When decomposition sets in or leaching occurs under such circumstances, the soil absorbs the fertilizing elements and retains them until needed by the growing crops. The largest possible quantity of fertility is thus retained in the land.

Besides saving the fertilizing elements of the manure, this method of application has the added advantage of economizing labor. It requires no more time to load the manure directly into a spreader or wagon than to wheel it out of the barn and dump it into a pile which must later be loaded and hauled to the field. Less labor is required, also, than where the manure is loaded into a wagon and hauled to a compost heap from which it must again be loaded and taken to the field.

One must recognize the fact that it is not possible on many farms to haul manure from the barn directly to the field throughout the year. Growing crops on the land to which the manure should be applied often interfere during the crop-growing season. Often other work, demanding the available labor, prevents daily removal of the manure to the fields. In the North, snow and cold weather make it difficult to operate a spreader in the wintertime. Whenever land is available, however, upon which to spread the manure, or when weather will permit, it should be taken directly from the barns and yards to the fields and spread evenly and rather thinly as hauled. In few instances is an application of more than ten or twelve tons an acre advisable. If heavier application is made, more nutritive elements will be liberated than can be used by the plants. They will be carried out of reach of the plants by leaching. Thinner applications, more frequently applied, will economize the fertility elements in the manure and make larger quantities available for crop production.

It is quite common practice to haul manure to the fields and unload in half-load to load piles. It is allowed to stand in these piles during the winter and is then spread by hand in the spring. Nearly as much loss occurs from decomposition and leaching when manure is handled in this manner as when it is allowed to lie in piles under the eaves of the barn. The labor of applying is also increased and the fertilizing value is not uniformly distributed. When manure can not be hauled directly to the fields, it should be spread out evenly over a level yard and the stock allowed to run over it, tramping it firmly. If the yard can have a concrete bottom, there will be less loss from leaching than where it lies on open ground. In many localities such floors are built

or concrete pits constructed in which the manures are accumulated until they can be hauled to the field. Such methods undoubtedly conserve the fertility elements, but they are expensive to build and increase the cost of handling the manure.

LIVESTOCK MUST BE ADAPTED TO THE FARM

The kind of livestock to keep on any individual farm depends upon several factors. It has yet to be proven that one kind of livestock is more profitable than another, when grown under favorable conditions. Profits are made from growing each class of livestock, but often one class is better adapted to a certain farm than another.

Size of Farm a Factor. The size of the farm operated is a large factor in determining what livestock should be kept. As a rule, small animals go with small farms. A five or ten-acre farm may be ample for the production of vegetables. On such farms little, if any, stock can be expected to pay profits. Usually, the animals kept on such farms are only those that supply power or that provide products for the farm family. A twenty-acre farm may be well adapted to poultry raising and would do fairly well for the production of a small number of pigs or sheep, if well farmed. It would not be adapted to dairying, beef-cattle raising, or the production of horses. These animals require large quantities of pasturage, forage, and coarse feeds, which could not be supplied from the farm. The animals would have to be kept closely confined, thus requiring much labor and adding to the expense. Studies show that it requires 2½ to 3 acres of good land to support a cow. This much land should supply summer grazing, winter forage, and the principal part of the grain feeds required. On a farm of 160 acres not more than 50 cows could well be kept. That would be stocking the farm at 3 acres per animal unit, provided no other livestock was kept. Few farms are so intensively stocked. A combination of 30 cows with 40 to 50 head of hogs would spread the labor load, more fully utilize the resources of the farm, and in all probability return greater profits.

Market Demands Must Be Considered. Market demands and shipping facilities must also be considered in deciding what kind of stock to keep. Livestock products are concentrated and easily shipped, if transportation is rapid and frequent. Milk and cream are somewhat perishable, however, and must be put on the market promptly and frequently. Live animals may be shipped long distances, but are subject to heavy shrinkage and loss by accident or death. Freight charges and care while on the road

must also be covered. Short distances are more favorable for livestock shipment. Grain and other imperishable products may more safely be shipped long distances.

Available Capital a Factor. The amount of capital available often determines the kind of livestock that can be kept. A farm can be more cheaply stocked with small animals than with large ones. The length of time which must elapse before returns can be made from the animals should also be considered. In this respect the advantage lies with the cows, as the milk and butterfat are immediately available for sale. With sheep, either the lamb or the wool crop is likely to mature within six months from the time of purchase. The return from hogs can rarely be realized short of six or eight months. In horse raising, the colt crop is not mature for market inside of three years, though younger colts are sometimes sold. Better prices can be secured, however, when they are over, rather than under, three years of age.

KEYS TO PROFITABLE LIVESTOCK PRODUCTION

As has been pointed out repeatedly, the objective in keeping livestock of any kind is to add to the net income from the farm. This statement must be interpreted to mean net income over a long period of years. Few operators are wise enough or adept enough to go into or out of livestock suddenly without incurring too great expense or meeting heavy losses. One should engage in livestock raising only when satisfied that the conditions prevailing in the area occupied are favorable for that type of business.

It may be well to summarize in a brief way some of the factors leading to profitable livestock production.

Ample Feed Supplies. The foundation of profitable livestock production lies in the grass crops. These are best offered in the way of good pastures on the arable lands and well-managed native grasses on the nontillable and range lands. Open pastures and ranges offer the most sanitary conditions for the production of livestock. Labor requirements while the animals are on grass are also reduced to the minimum. The rapid gains and high production by animals on grass and the low labor expense of caring for them at such times offer the best margin of profit.

It is important that the farm or the range supply in adequate quantities the cured forage and rough feeds needed to care for stock through the season of the year when pasture lands are not available. The more nearly such forages can supply the nutrients offered under pasture conditions the better the production

from the animals. Good quality alfalfa, soybean or other legume hay will carry some classes of livestock satisfactorily without grain supplement. If satisfactory growth is made or weight and condition maintained on such feed, the cost is much less than where grain must be fed.

Where heavy production is expected from the animals or where rapid gains are desired, grain supplements of one kind or another must be provided. The nature of these supplements will depend on the work to be done and the quality of the other feeds supplied. For high production, it is essential that the grain supplements be of good quality and palatable. Minimum rather than maximum quantities are likely to pay the highest returns. Heavy feeding of grain concentrates, however, is sometimes advisable in rapidly finishing either beef cattle or hogs. Concentrates are sometimes justified also in rations for dairy cows that are forced to high production. Unless one is able to supply ample feed, it is unwise to undertake livestock ventures. No money is to be made from poorly fed livestock.

Good Management and Care. The well-doing of animals depends upon bodily comfort. To supply conditions which will permit such comfort is one of the many problems of the farm operator. Pretentious buildings, rigid stanchions, and poorly ventilated quarters do not mean comfort to the animals. One of the reasons why animals do best on pastures and open ranges is because they are free to adapt themselves to conditions and gain the greatest possible bodily comfort. Under such conditions they are contented and at ease, which is more than can be said of much of the livestock forced to live in barns and yards. Comfortable quarters in a moderate barn may give much better results than uncomfortable quarters in a pretentious barn. Dairy cows, confined for a large part of the time during the winter in stanchions on hard cement floors, enjoy a period of relaxation in a sunny shed or even in an outdoor yard on a warm day. Those who allow their cows the privileges of an exercising shed during the winter months get better production records than those who permit no such relaxation.

The timely feeding, the provision of water at will, and attention to all matters that will give desirable bodily comfort and contentment are the essentials of good management. With these, the quarters must be kept in good sanitary condition whether the animals are in pastures, yards, or barns. Good health, good quarters, and ample feed are the key to profitable animal production.

✓ CHAPTER XI

PLANNING THE PHYSICAL ORGANIZATION OF THE FARM

Planning the physical layout is one of the primary and fundamental problems of farm organization. Most farms were developed, the field arrangements set up, and buildings and fences constructed, when conditions were far different than they are today. Not only have systems of farming changed but there have been radical changes in farm practice, power, machinery, and other factors that condition the farm layout. A farm that was laid out for operation by horsepower fifty years ago may have been an efficient unit at the time with the practices that then prevailed, but it is likely to need numerous readjustments to fit it for efficient operation with modern mechanized equipment. Since there is now so little new land to be developed for agriculture the farm manager seldom has the opportunity to lay out a new farm unit. There are, however, on established units and on new combinations of farm units ample opportunities for large savings in operating costs through a more effective physical layout.

PLANNING THE FARMSTEAD

The farmstead is the center of farm operations. It includes the home, the farm buildings, and the yards, paddocks, garden, orchard, windbreak, and other service areas. Its location and arrangement are important factors from both a personal and a business standpoint. An attractive farmstead adds much to enjoyment of farm life. A well-located and arranged farmstead may help greatly in using labor most advantageously. On livestock farms much more time is spent at the farmstead than in the fields. Most of the crops are brought to the farmstead to be fed, stored, or prepared for market. Manure must be hauled from the farmstead to the fields. Dairy cows must be brought to the farmstead twice a day and on many farms all livestock must come to the farmstead for water.

Location of Farmstead. On most established farms the farmstead is already located and the large investment in permanent buildings may make it uneconomical to change. In such cases the location must be accepted but rearrangement of minor build-

ings, lanes, yards, and other features may effect labor saving and increase the attractiveness. When a relocation of the farmstead is feasible or a new farm is laid out, certain factors should be considered. From the standpoint of convenience in getting to and from the farm a position near the highway is desirable. Passing travel will create interest and break the monotony of daily routine in the household. Telephone and electric lines are more easily accessible. On the other hand travel to the fields is reduced if the farmstead is located near the center of the farm.

A location on the highway in the center of one side of the farm is generally the most satisfactory compromise. This avoids the necessity of maintaining an all-weather road from the public road to the farmstead. In northern climates it may require considerable effort to keep a long lane free from snow in winter. In the days of horse travel this was not so important but with practically all road travel motorized it is more important to keep a road open and passable at all times. The extra time spent in reaching the fields from the farmstead is not so serious a handicap under present conditions. Modern tractors travel more rapidly than horses, and labor-saving machinery coupled with larger power units reduces the number of hours required to produce an acre of crops.

Another factor affecting the location of the farmstead is the matter of view and the facing. Often a particularly pleasant view or a lake will be an important consideration. A high and well-drained but not excessively sloping location is desirable. Ordinarily an east or south facing is desirable. Where prevailing winds, especially in winter, are from the north and west, a south or east facing makes possible a windbreak without cutting off the view of the public road.

SIZE AND ARRANGEMENT OF FARMSTEAD. The size of a farmstead is determined largely by the size of farm and type of farming. A larger farmstead is usually required on a livestock farm than on a cash crop farm. In localities where windbreaks are needed, a larger area is required to accommodate them. From four to six acres are usually sufficient for a 160-acre livestock farm and from six to ten acres for a 240 to 320-acre farm.

THE FARM HOUSE. In arranging the farmstead the house should have first consideration. Good drainage and a sightly position are the essentials. Possibilities for pleasant views, landscaping, and sunshine should be deciding factors of choice. Groves, windbreaks, and decorative plantings should be planned

with the idea of giving the house an attractive setting. It is desirable to have the house at least 100 to 150 feet back from the road to escape dust and noise. Usually the house should be the same distance from barns and other farm buildings to reduce the fire hazard and avoid odors.

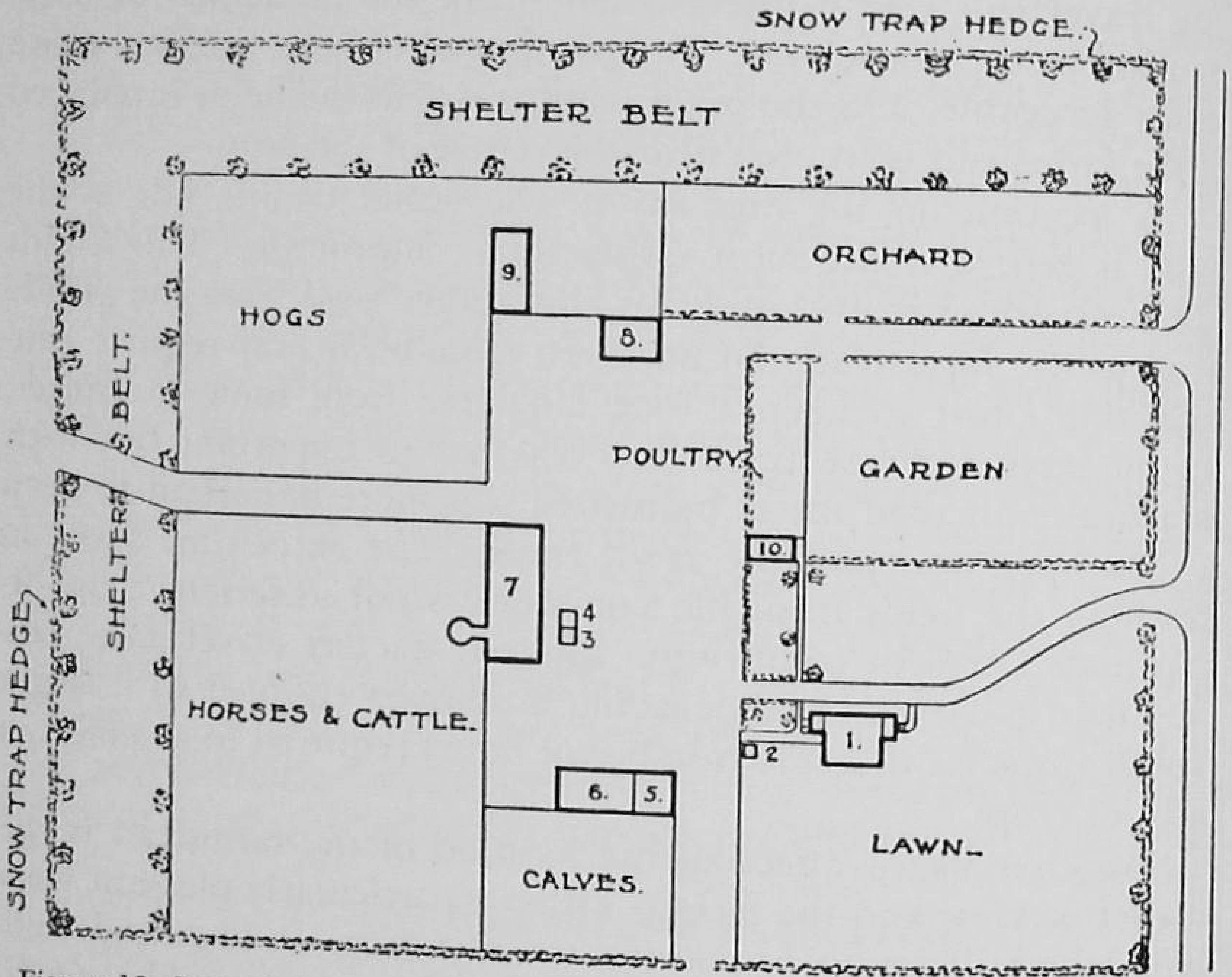


Figure 16. Plan of a well-arranged farmstead, facing east.[1]

1. House
2. Well
3. Milk house
4. Icehouse
5. Shop and garage
6. Machine shed
7. Barn
8. Corncrib and granary
9. Hog house
10. Poultry house

[1] From *Minnesota Special Bulletin 175.*

The Farm Buildings. Groupings of buildings should be made with a view to convenience and economy of time in doing chore work. The horse barn and machine shed should be near one another and near the road or lane leading to the fields. Cattle barns and buildings for feed supplies should be located closely together. Bulky feeds, especially, should be stored close to where they are to be used. The hog house, feeding floor, and corn crib should be easily accessible to each other. Livestock paddocks should be convenient to the buildings served.

A conveniently arranged farmstead is illustrated in Figure 16.

By placing the buildings about a hollow square, a compact arrangement is possible and all are easily accessible to fields, paddocks, or other areas served. When a farmstead is already built up, only minor changes may be practicable but the plan indicates a desirable pattern toward which an existing farmstead may be adjusted from time to time as changes become possible. In planning a farmstead it is quite desirable to be farsighted and plan for structures or features that will be added later. Much confusion can be avoided if places for them are chosen and construction is planned accordingly.

Most farm buildings last the life of at least one generation, and as a result few farmers have much experience in locating, planning, or designing them. The inexperienced builder is likely to spend too much and get too little in return in the way of satisfactory or convenient arrangement. Fortunately the agricultural colleges in most states have plans and specifications available for farm buildings adapted to local conditions. Many dealers in building materials and building equipment also have planning services available to farmers. In many states the agricultural extension division has specialists in farm building to assist farmers with plans for remodeling old structures as well as for constructing new ones. Many costly mistakes in building construction can be avoided by the use of these services. The planning and construction of each farm building is more or less of an individual problem, but the general principles of sound construction and convenient arrangement as worked out by building specialists can be applied. Since conditions may change during the life of a building and it may be necessary to adapt it to some use for which it was not originally designed, it is especially important to adhere to fairly standardized plans that have a considerable degree of flexibility as to use. It is especially important that the plans be such that the building may be enlarged without excessive expense and without impairing its convenience and usefulness.

PLANNING THE FIELD ARRANGEMENT

There are usually more opportunities for improving the field arrangement than the farmstead layout. On some farms physical features such as topography or drainage, timber, stumps or stone, diversity of soil type, highways, railroads, streams, and lakes may complicate the problem and limit the possibilities for improved layout but they do not eliminate them. Some of the

general considerations to keep in mind in planning the field arrangement are presented in the following sections.

Access to Farmstead. As has already been pointed out, the farmstead is the center of farm operations. Fields must be laid out in relation to the farmstead so as to reduce the distance traveled in going to and from them and also to reduce the amount of fences for lanes from the farmstead to pasture fields. Tillable pasture may be located close to the farmstead but permanent pasture must be utilized wherever it is located. Although it is usually desirable to have pasture located close to the farmstead, it may sometimes be economical to use distant fields as pasture, especially if the stock does not need to be brought to the farmstead for milking, watering, or other frequent attention. Often it is necessary to have two or more rotations on a single farm. In such case the one containing the more intensive crops should, usually, be located close to the farmstead since more frequent trips must be made to these fields.

Number and Size of Fields. The number of fields should be determined by the number of years in the rotation. For labor economy large fields are desirable. However, it is important that fields be uniform in size within a given rotation, so as to provide the uniform supply of crops for feed or sale each year. They should also be reasonably uniform in soil type, topography, and drainage so that the whole field may be planted to one crop. In case physical conditions make uniform size of fields impossible, it may be necessary to combine two small fields into one unit for purposes of rotation. Where strip cropping or contour farming is necessary to control soil erosion it is also difficult to secure uniform rotation units without combining several strips into one unit.

Shape of Fields. It is desirable to have rectangular fields, preferably with the length at least twice the width. Square fields are most economical of fencing but require more time for most operations than do long, narrow fields. Where crops that require cross cultivation are grown, considerable time is lost in this operation if the field is so narrow as to make the cross rows too short for economical operation. Often natural obstructions necessitate some irregularity in field shape. Sometimes small irregular areas, especially those with acute angles, may better be seeded down as permanent pasture or hay than included in the regular rotation.

Fitting the Rotation to the Field Arrangement. The farm that is all tillable usually represents a relatively simple problem

in fitting a rotation to a desirable field arrangement. A suggested field layout for a six-year rotation for a 160-acre farm is shown in Figure 17. All fields are of uniform size, rectangular in shape, and long enough relative to width so that they may be worked

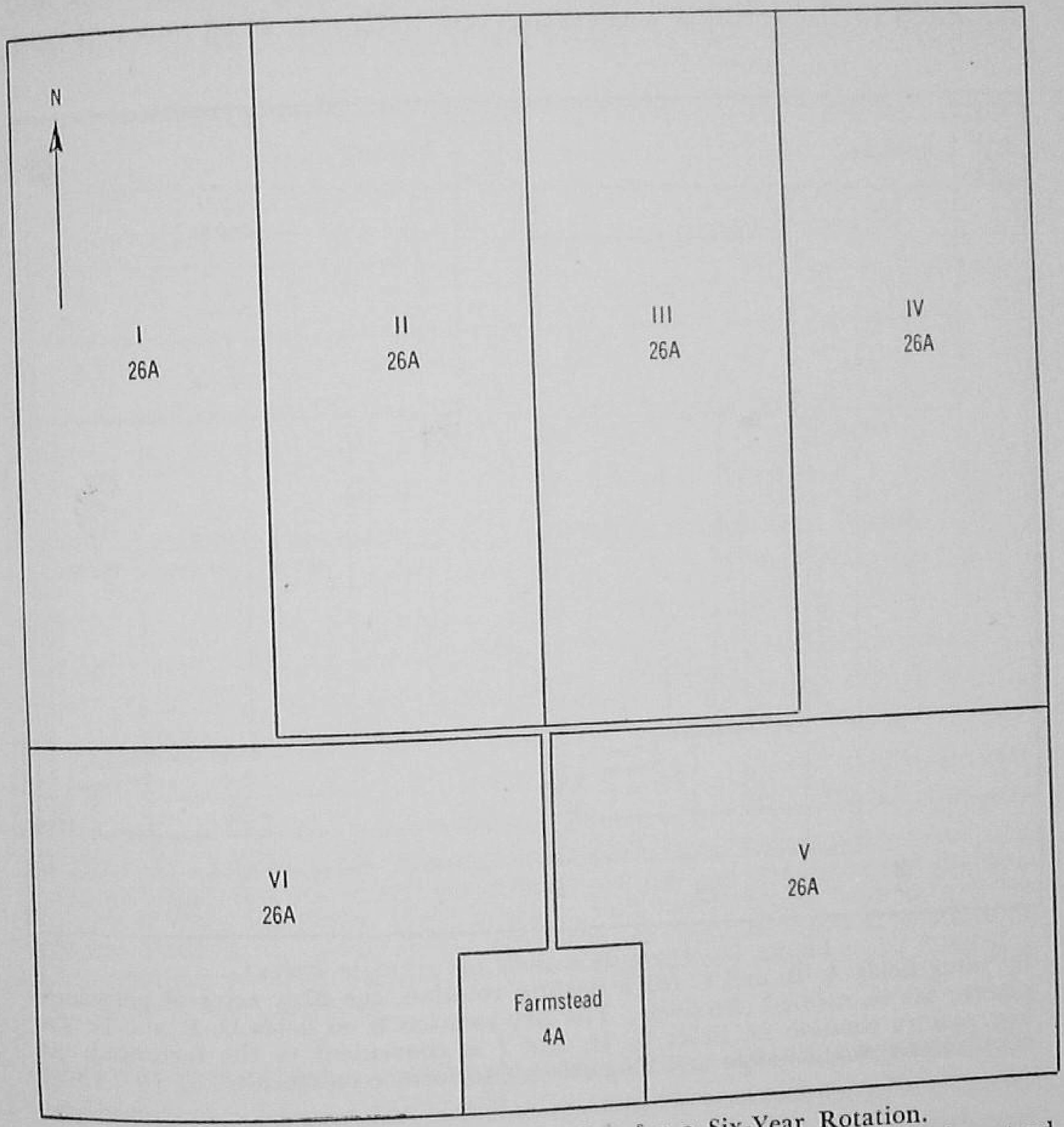


Figure 17. 160-Acre Farm Laid Out for a Six-Year Rotation. Fields are of uniform size, regular shape, and easily accessible to the farmstead by short lanes.

effectively. All fields are accessible to the farmstead by relatively short lanes.

Unfortunately few farms are all tillable and regular in outline like the one shown in Figure 17. An example of a farm on which considerable areas of wet land resulted in an irregular field arrangement is shown in Figure 18 (a). A rearrangement for fields that provides for three separate rotations is shown in Figure

18 (b). The low areas were tiled and all except 27½ acres for which no outlet was available were drained. These 27½ acres provide a fair quality of pasture, and a stream running through it furnishes water. Since more pasture was required, a three-year rotation containing tillable pasture was laid out on Fields A, B, and C. Each of these fields was connected with the 27½ acres of non-

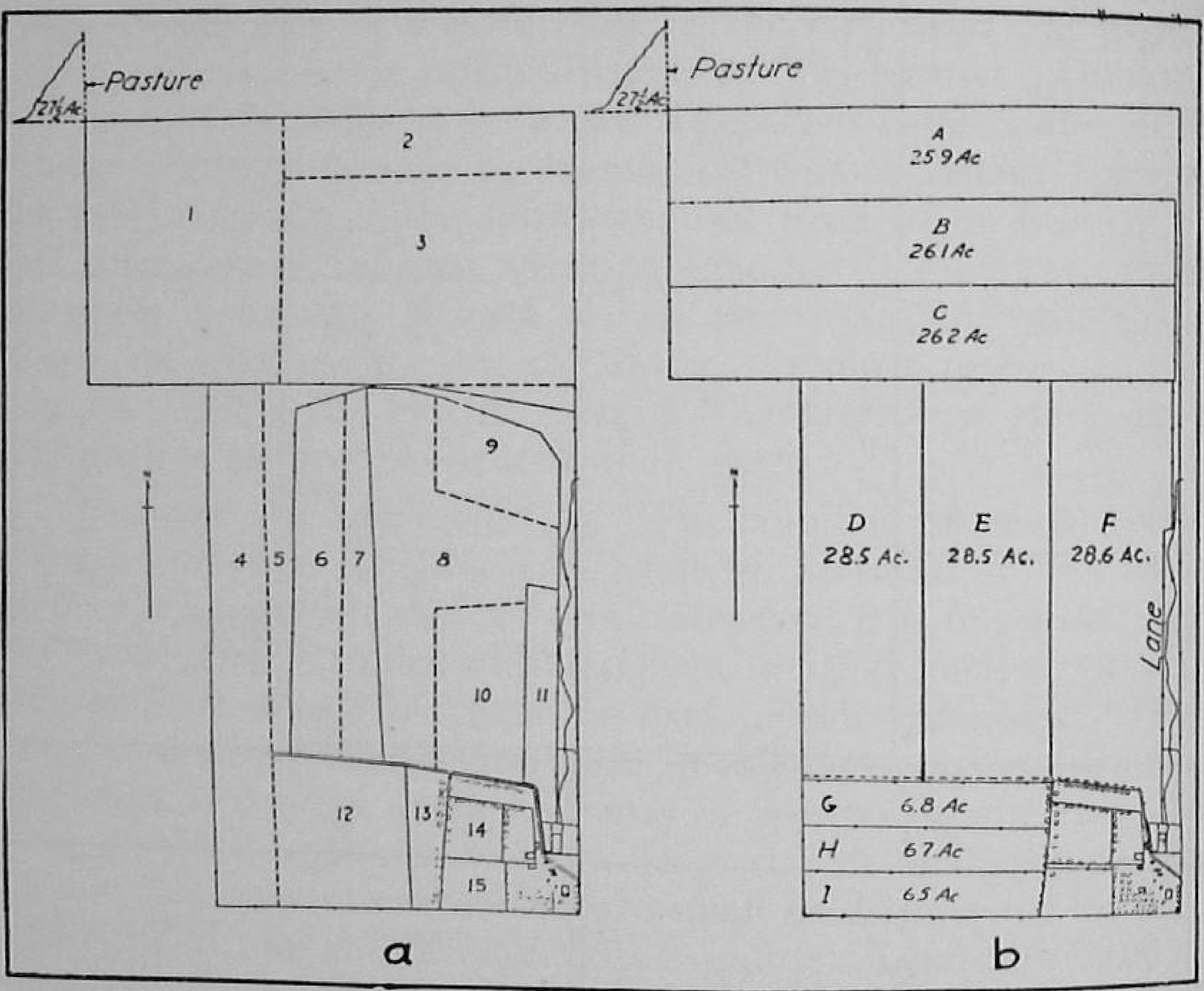


Figure 18. Three Rotations on a Single Farm.[1]
By using fields A, B, and C for a pasture rotation, the 27½ acres of permanent pasture can be utilized effectively. The hay rotation is on fields D, E, and F. The hog pasture rotation on fields G, H, and I is convenient to the farmstead. All fields are regular in shape and long enough to work economically.

tillable pasture by lanes so that both pastures could be used at the same time. A three-year rotation including a hay crop was laid out for Fields D, E, and F and a hog pasture rotation for Fields G, H, and I. In this way large rectangular fields were secured, and the non-tillable pasture was used to best advantage. Since little labor is required for a pasture crop, it was included in the rotation most distant from the farmstead. Hay, which requires the most labor per acre of any crop on this farm and

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[1] *Bulletin 350*, Minnesota Agricultural Experiment Station, Fig. 1, p. 6.

hence the most trips to the field, was located close to the farmstead. This represents a very effective use of the land, and definite labor saving.

Obstructions such as roads, woods, and poorly drained areas complicate the problem of field arrangement. This is illustrated in Figure 19 (a). This farm is crossed by two public roads as

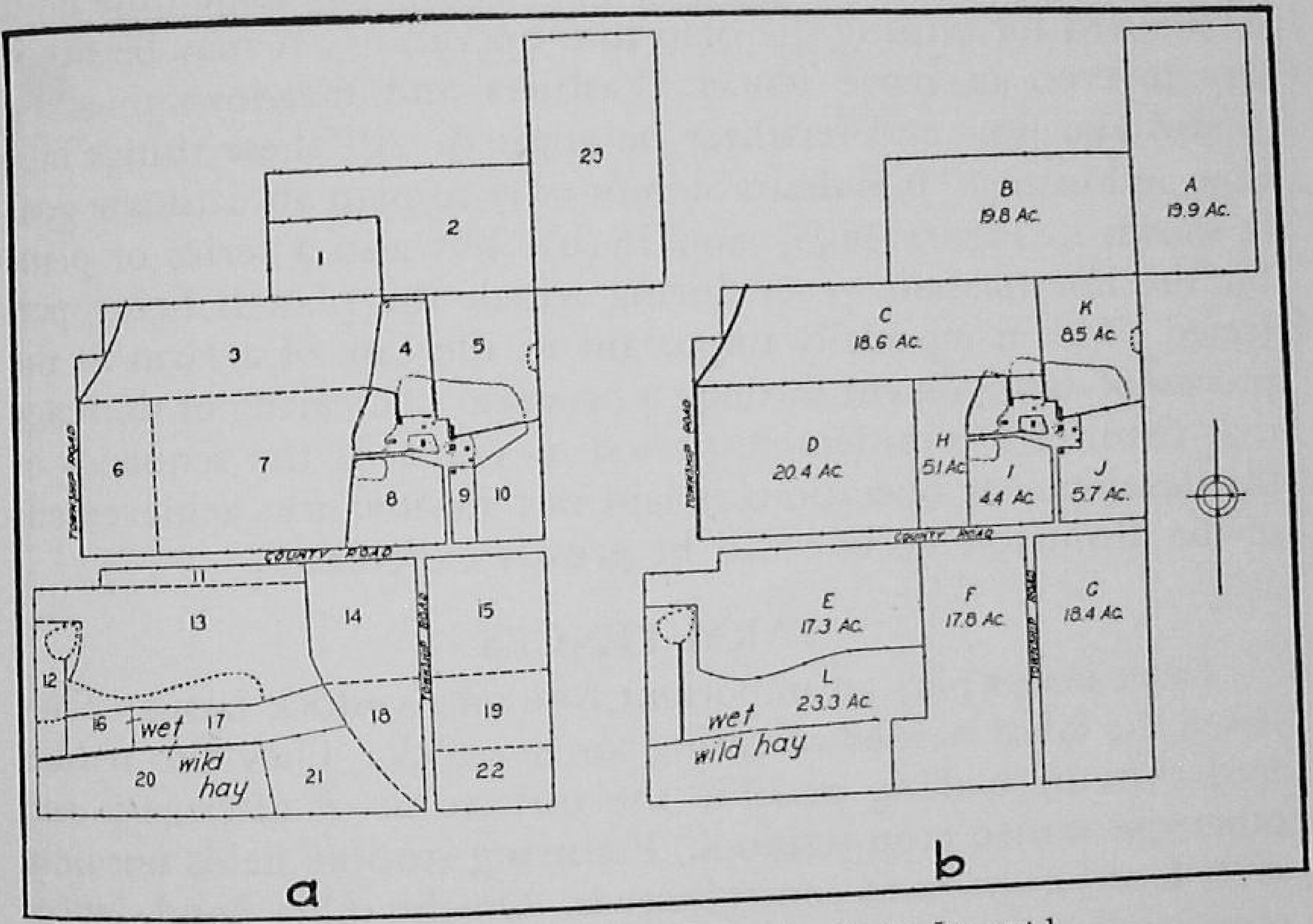

Figure 19. A Difficult Problem in Farm Layout.[1]
Irregular boundaries, roads, and non-tillable pasture land complicate this problem. In spite of these handicaps, three rotations with fairly regular fields furnish the solution: Fields A, B, C, and D in a dairy pasture rotation; Fields E, F, and G in a hay rotation; and Fields H, I, and J in a hog pasture rotation; and Field K is reserved as a night pasture.

well as by the private road to the farmstead. An area in the southwest corner is too wet for regular cropping and can not be drained because no outlet is available. This field contains water and may be used as pasture. However, it is so far from the farmstead, and separated from it by a public road, that it would not be feasible to use it for dairy cows. The field arrangement shown in Figure 19 (b) shows how, by using three different rotations, a fairly satisfactory layout may be secured. A four-year major rotation including pasture for dairy cows is followed on Fields A, B, C, and D. A three-year hay rotation is followed on Fields E, F, and G and a minor rotation on Fields I, H, and J. Field K is non-

[1] *Bulletin 350,* Minnesota Agricultural Experiment Station, Fig. 2, p. 7.

tillable permanent pasture. The slight irregularities in these fields do not interfere greatly with economy of operation. Many farms represent this type of problem. Even though the revised plan has its flaws, the time and effort spent in planning it has made possible a large gain in economy of operation and has helped to stabilize the whole farm business.

In any program of improving the farm layout some time must be allowed for putting the plan into operation. It may be necessary to erect or move fences. Pastures and meadows must be seeded and lime and fertilizer be applied. All these things take time and money. It is desirable not only to plan an ultimate goal as shown in Figure 18 (a) and 18 (b), but also a series of plans for the intermediate years during which the plan is being perfected. This is especially important in the case of a farm in the process of development through a program of clearing or drainage that requires a considerable period of years. If the sequence of the development operations is laid out in advance, achievement of the ultimate objective will be greatly expedited.

FARM FENCES

Farm fences play an important role on livestock farms. They lessen the labor needed in caring for livestock. They also reduce feed costs by making possible the utilization of aftermath and otherwise wasted crop residues. Pasturing stubble fields not only saves feed but helps to control weeds. On the other hand, fences obstruct farm operations and occupy valuable land. Fence rows harbor weed and insect pests. Some fences are dangerous to livestock. The construction and maintenance of fences involve considerable expense and labor. The cost of fencing at prewar prices varied from 48 cents per rod for a three-strand barbed wire fence to $1.18 per rod for a 58-inch standard woven wire fence with one strand of barbed wire.[1]

The size and shape of field is an important factor in fence costs. The larger the field the less is the cost per acre. Fifty rods of fencing are required to enclose a square acre, 16 rods per acre for a square 10 acres, 8 rods per acre for a square 40 acres, 4 rods per acre for a square 160 acres, and only 2 rods per acre for a square 640 acres. A square field takes less fencing than a long narrow field. Twenty-five per cent more fence is required to fence a 40-acre field twice as long as it is wide than to fence a square forty. On the other hand, the longer fields are much more

[1] M. A. R. Kelley, "Farm Fences," *U. S. Farmers' Bulletin 1831*, January, 1940.

economical of labor. In planning the fencing program, the farmer must strike a balance between these two considerations. Many farmers reduce fencing costs by the use of electric fences, especially for temporary fencing. When properly safeguarded, they offer considerable opportunity for reducing the investment in farm fencing.

CHAPTER XII

ORGANIZATION OF THE FARM UNIT

The nature of farming in the United States varies greatly from region to region, as was indicated in Chapter VII. Even within any of the regions there discussed, wide variations are found, not only in the products grown from farm to farm, but in the way in which the same products are grown on different farms. Differences are found also in the amount of land included in the farm unit, of labor applied to the land, and of equipment provided with which to operate.

These variations are due largely to differences in the ability of the operators to command the facilities required for farming. Differences in their views and conclusions as to the specific combination of the factors of production that will best satisfy their individual desires, capacities, and needs, also enter into the problem of setting up a farm business.

Some farmers and their families are satisfied with the establishment of a modest farm home, supported by land enough to permit the growth of the major food products required by the family. A surplus of some crops or products usually will be produced for sale to provide exchange for the necessities that can not be produced from the farm or cash income for these necessities may be earned by part-time work off the farm by members of the farm family. Farms answering this description are called self-sufficing farms, as products from them serve mainly the operating family and do not enter into the commercial channels. Few of these farms are operated under any semblance of an organized long-time plan. A home for the family and a modest livelihood are the utmost expected from farms of this type.[1]

Ambitious farmers desire more than a mere livelihood from their farms. Besides establishing a home on the farm and gaining a livelihood from it, these farmers seek to earn sufficient cash income to provide a competence for old age and to permit the acceptance of opportunities for educational advantages, travel, and social advancement for the family. Where such objectives are

[1] See discussion of self-sufficing farms, Chapter VII, page 79.

set up, it becomes necessary to give greater attention to efficient operation. Long-time plans must be made for insuring a good annual income, in addition to that part of the family living gained directly from the farm. Such objectives call for correct balance of the elementary factors of production that enter into a farm business. They call for a full utilization of all the resources at the operator's command. It is important to know what these factors of production are and how they can best be combined in a well-balanced, organized plan for operating a farm unit. Because interest is chiefly centered on producing farm products for cash sale and because these farmers are good buyers of commercially-produced goods, American farming, on the whole, has become highly commercialized, with farms organized into specific business units.

ELEMENTS REQUIRED FOR A FARM BUSINESS UNIT

There are four primary elements required in establishing a farm business unit of any kind. These are (1) capital, (2) land, (3) labor, (4) management. Various combinations of these elements are made in organizing farm business units. The proportions used in each instance will depend upon the relative abundance of each element available to the prospective farm operator and to their prevailing relative values. A brief discussion of these elements will be helpful in arriving at an understanding of how to plan and analyze a farm business.

CAPITAL. Capital is usually regarded as money or its equivalent in financial assets. Actually, capital may be in many forms of goods other than money. Farming is a business that requires a considerable capital investment. After land has been acquired for a farm, tools, machines, power, seed grain, and sometimes fertilizer, must be supplied before operations can begin. Buildings must be provided to accommodate those who live upon the farm and to house and store the products raised. Often productive livestock, such as brood sows, dairy cows, and poultry, are needed to fully utilize the productive capacity of the land. To obtain these, a farmer converts money or personal credit into the needed equipment, which takes on the form of capital goods.

LAND. For several reasons, land deserves special consideration in setting up a farm business: (1) There can be no farm until land is provided. (2) Good agricultural land is limited in quantity. (3) Soil varies greatly in quality and productive power. (4) Land can not be moved about as other forms of capital goods

may be. The location, therefore, is very important. (5) When capital is invested in land, it becomes a permanent investment and can not always be easily withdrawn or converted. (6) Ownership of land is desirable when it can be acquired without seriously limiting the other necessary elements. On owned farms, a large part of the capital investment is represented in the land. On farms that are leased, a rental fee in share or in cash is a charge against capital investment, which must be met to gain the use of the land.

LABOR. Labor wisely expended upon the land will greatly increase the products of it. Land by itself is seldom economically productive. It may, in its natural state, produce a crop of grass, shrubs, or trees; but in such slow order or of such little utility as to have small economic value in the present day. Labor is required to increase the income from the land. The manual labor on most farms is performed by the operator and his family, supplemented when necessary by hired labor at such seasons as the labor load is more than can be performed by the family. Man labor on most farms may be supplemented to great advantage by using it in combination with animal or motor power in operating implements and machinery. Such combinations account for the relatively small proportion of man labor used on American farms and the relatively high investment in machines and power.

MANAGEMENT. Good management is required if the returns to capital investment, land use, and labor employed are to be adequate and satisfactory. The function of management is to bring into effective and harmonious working relations all phases of the capital, land, and labor elements involved in a farm business. Management determines the distribution of capital invested in the business, the amount of land to be included in the unit, the amount and kind of labor to be used, and the farm enterprise upon which it shall be employed. In fact management is chiefly concerned with making the right decisions on all matters of importance and in securing successful completion of them after the decisions are made. The business success which attends a farm unit is largely determined by the quality of the management given it. The function of management must usually be assumed by the farm operator, whether he be an owner or a tenant. It is highly important, therefore, that prospective farm operators gain a full understanding of the nature of the elements entering into a farm business and that they learn how to organize them into a sound operating program.

FARM ORGANIZATION ESSENTIAL FOR EFFICIENT PRODUCTION

But just what is meant by organization? To organize means to arrange or constitute in parts with each part having a specific function, office, or relation. In short, it means to bring into effective and harmonious working relationship all the parts of the whole. Applied to a farm it calls for the development of a well-balanced plan for equipping and operating. It requires that the land be so used as to give maximum return to the operator. It demands the most effective use of available power and labor. Available capital must be wisely distributed between the fixed form in land and buildings and the more flexible forms invested in work stock, machines, and operating expenses. These items in good balance, accompanied by careful attention to cash expense should result in the largest possible net income to the operator. Plans must be made to have full time employment for all available labor. To earn income for the farmer, the labor must be employed on what is termed productive enterprises, such as raising crops, fattening cattle and hogs, or milking cows. Labor employed on such enterprises will return commodities for use or sale. There can be no income from labor expended on the upkeep of buildings, repair of fences, and in tidying up the dooryard. These operations are not directly productive. They are, nevertheless, advisable and in the long run will prevent outlay, even though they do not add directly to the income. They add to the social values of the farm and are often necessary to the complete functioning of the farm enterprises.

Organization of a farm should begin with a complete inventory of the farm unit. The inventory should be accompanied by a survey map of the farm, showing the details of field divisions, land quality, and the crop production program. From the inventory and map, a production statement can be developed, showing the kind and amount of products raised. These data will serve as a basis for an analytic study of the efficiency of the organization scheme and for developing a plan of reorganization in instances where that proves to be advisable.

Because crop production is more directly governed and limited by physical conditions[1] than by livestock production, it is well to build the operating plan for a farm around the cropping possibilities for the area occupied. The kind of livestock kept will

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[1] See Chapter V, page 54.

often depend to a large extent upon the kinds of crops and forages that can be grown in a locality.

It will be helpful in understanding the principles of farm organization to center study for a time on the records of a farm in active operation. To serve as a pattern or example of farm organization and analysis, the records from a dairy farm in southeastern Minnesota are offered and discussed in following chapters. The authors realize that not all farms are dairy farms. Though the organization of a dairy farm is somewhat more complex than that of some other types, the same process of inventory, mapping, and analysis is involved in studying the organization of any type of farm. The principles underlying the organization are the same. The procedure outlined here may be applied as well to a farm operated for beef or hog or grain production.

CHAPTER XIII

MAPPING THE FARM AND MEASURING PRODUCTION

Maps, showing various details of the farm unit, will be most helpful in determining whether or not a farm is well organized. These will serve also as a basis for studying what to do if the farm proves to be poorly organized Two maps are essential at this time. (1) An original, or base map, showing the present boundaries of the farm, together with the field divisions and the farmstead location; and (2), a topographic and soils map, showing the lay of the land and the quality of the soil. Other maps may be needed after the first study has been made and if reorganization is to be undertaken.

The *base map* consists of an outline drawing, showing the present boundaries of the farm. The map should be drawn to suitable scale, with distances between points carefully measured or estimated. (A scale of 1″ = 20 rods will be satisfactory in most cases.) This map should show the natural subdivisions of the farm with streams, ditches, or other obstacles to cultivation, indicated by suitable symbols. If the farm being studied is in a soil-conservation district, the contours and scheme of cropping may be indicated. Airplane photos, where available in county offices, are often useful in studying the present layout. Field divisions should be outlined. The location of the farmstead should be accurately indicated, together with the location of trees, windbreaks, and other permanent features. The relative position of the farm buildings may well be indicated where space will allow. For reorganization purposes, it may be advisable to make a large scale map, showing the farmstead alone, that building placement may be more carefully considered. The base map should show all roads, lanes, and fence lines, with appropriate symbols, indicating type of fence used. Fields should be named, numbered, or lettered, for identification and ready reference. The crops grown upon each field should be shown, together with the number of acres in the field. See Figure 20, Base Map of a Dairy Farm in Southeast Minnesota.

A variety of soils may be found on many farms. There will be differences in physical texture as well as in chemical com-

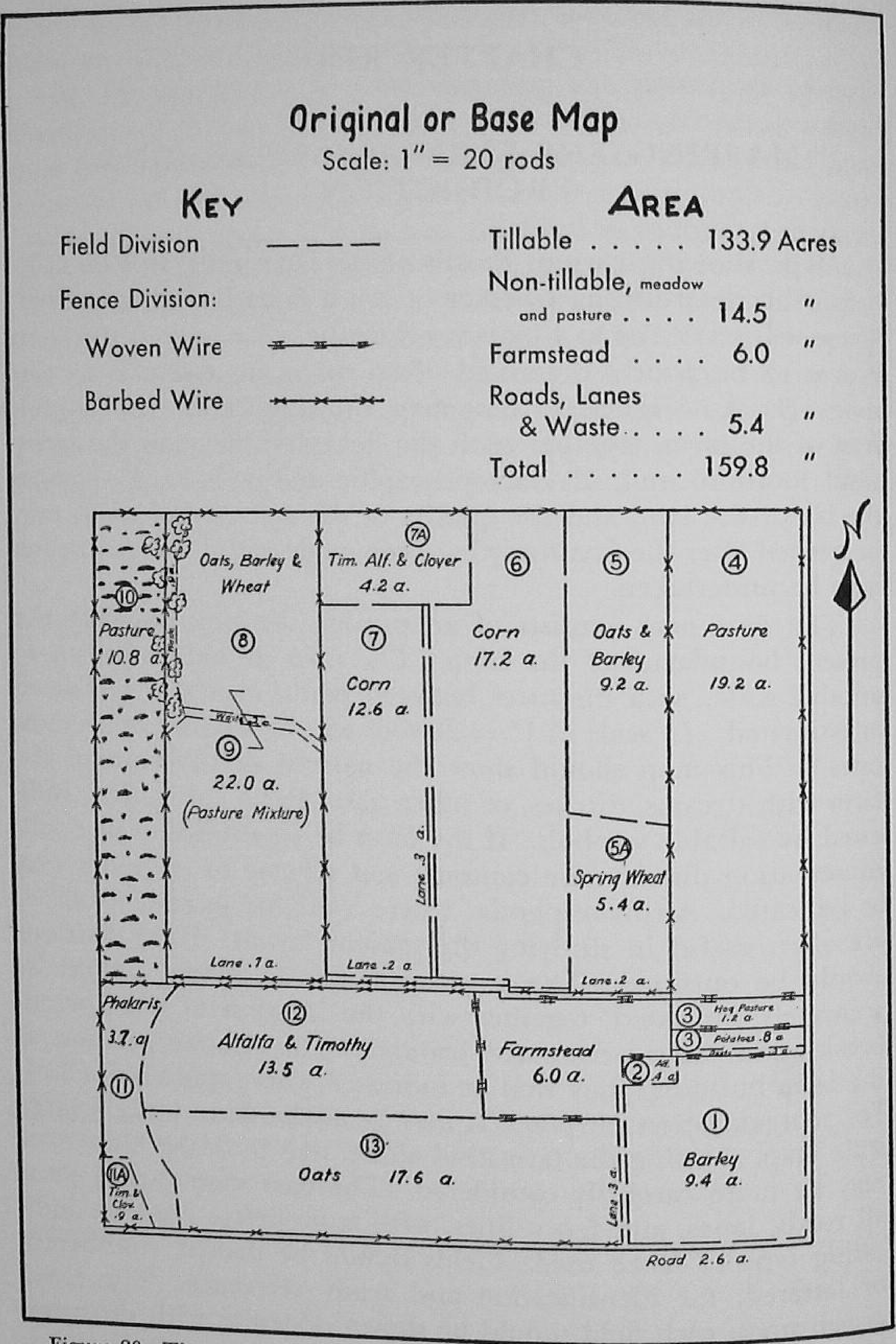

Figure 20. The original or base map of a southeastern Minnesota dairy farm.*

*The original farm map should record as nearly as possible all physical features of the farm. Groves, trees, ditches, field divisions, and fence lines should be accurately located. The farmstead size and location and other permanent objects that must be worked around should be closely indicated.

position of the soils on different parts of the farm. These differences should be taken into account in making the cropping plans for the farm. Topography also affects the cropping practices to be followed. Variations in physical texture and in chemical composition can be determined by simple examinations and tests.

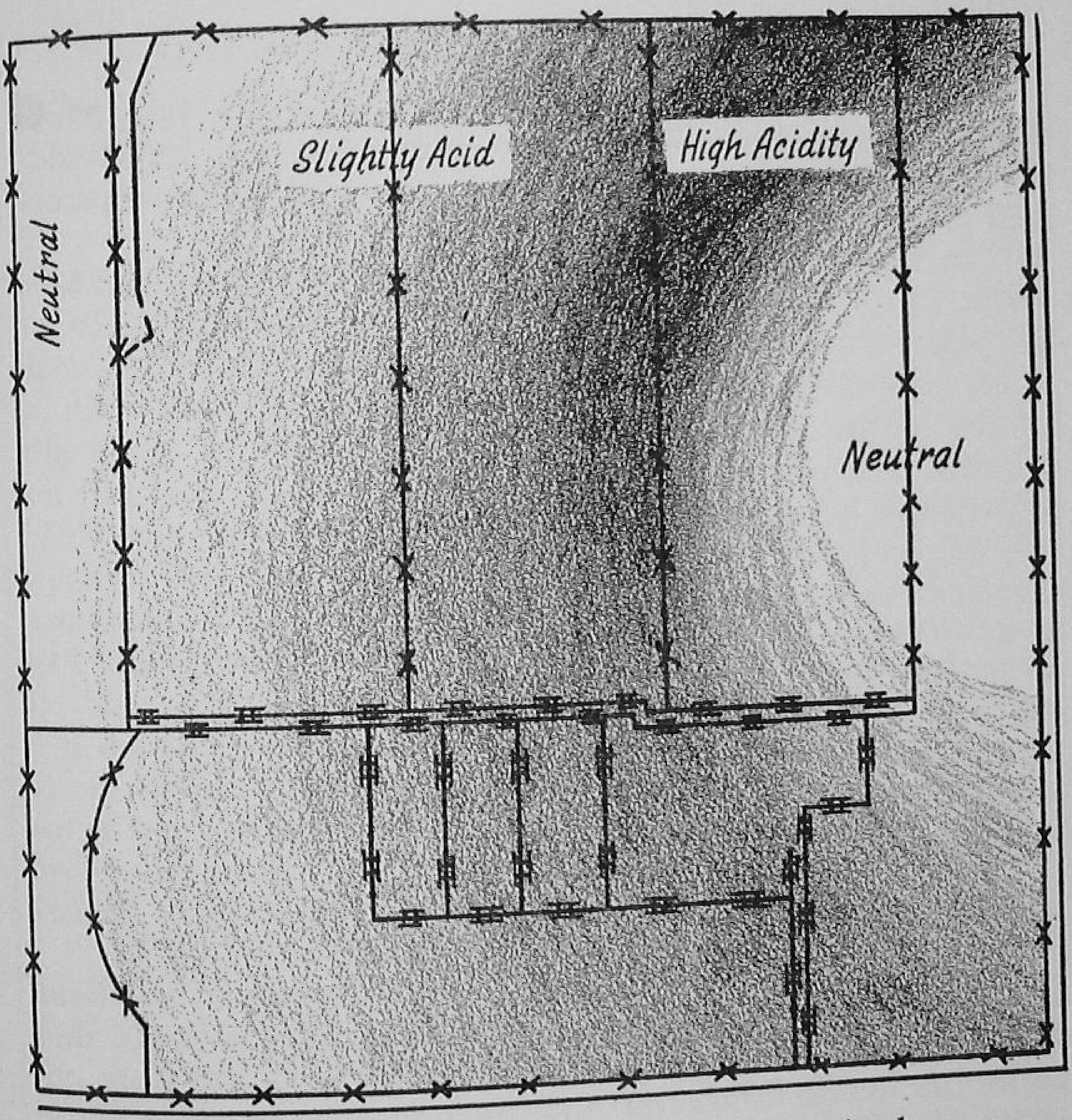

Figure 21. Soil map of the farm under discussion.[1]

Most county agricultural extension services have the equipment to make these tests.

The subsoil should be examined, as well as the surface soil. By the use of a soil auger or a post-hole digger, borings should be made to a depth of two to three feet at each point on the farm

[1] For a farm that varies widely in soil types an additional map may be made to show the physical characteristics of the soil on each field. Where the farm is uniform in soil type there will be no need for more than one soil map.

where soil differences appear. The physical qualities of the subsoil are quite as important as of the surface. A sandy or gravel subsoil is likely to be drouthy and infertile.

Only the rough topographic features need be recognized as they affect the tillage of the land. Figure 21 indicates what a *soils map* may be expected to show.

STUDY OF THE DAIRY FARM MAPS

When the maps have been completed they should be carefully studied. They supplement the inventory and give much additional information that will need to be considered when a permanent plan of organization is developed.

THE BASE MAP. The map of the dairy farm in southeast Minnesota, Figure 20, shows some weak points in organization. In the first place, there are too many fields, some of which are too small to be worked economically. The size of the fields in some instances is due to physical determinants which are not easily overcome. In others, it seems to be only a matter of small improvements, which will permit reorganization into more desirably shaped fields. In the second place, while the fields are fairly regular in shape, they are uneven in size, resulting, in some cases, in the necessity of using parts of each for different crops. Part of the farm is uneven and not suited for use as tillable land. In this instance, it is reserved as a permanent pasture, though it is located at the farthest possible point from the farmstead, necessitating considerable travel to reach it. Still another part is too low and wet for tillage purposes. This part is now made to yield a crop by growing Reed Canary Grass (botanically *Phalaris arundinacea*) as a permanent meadow, or pasture.

The farmstead, located as it is near the center of the farm, has the good quality of bordering on many of the fields, thus shortening the distance traveled to get to them before work can begin. Its location, however, interferes to a considerable extent with so reorganizing the farm as to permit equal-sized fields for crop rotation purposes. Fortunately, with the exception of the permanent pasture land and the slough land, the soil is a fairly uniform clay loam and suitable for cropping.

THE SOIL MAP. The dairy farm used in this study has been tested only for soil acidity. As is frequently found, there is quite a wide variation from field to field in the amount of calcium or lime in the soil. Low lime content means high acidity. A highly acid soil must be limed before alfalfa or sweet clover can be

successfully produced. The addition of lime in some cases also helps the growth of the true grasses. Simpler methods of testing soils for acidity have been developed. Commercial firms have prepared kits, containing the chemicals needed and the apparatus for making the test, which can be purchased at reasonable figures. The instructions for making the soil tests come with each set.

On the farm in question, it will be noted that there are so-called neutral areas, where sufficient lime is present to grow satisfactory crops. Other fields are slightly acid and on some of the higher land, running through the center of the farm, there is quite a high degree of acidity. On all this highly acid land, an application of one and one half or two tons of finely ground limestone is required for the successful production of alfalfa or sweet clover. On fields 7, 8, and 9 of the original map, the soil runs from slightly acid to acid. It is probable that one to one and one half tons of lime on these fields would be sufficient, as it would be on fields 12 and 13. There is no harm, however, in application of as much as two to two and one half tons. The higher cost of the heavier application, of course, would suggest the lighter applications, except where a very high degree of acidity is found.

The small field, permanently in Reed Canary Grass, is low and somewhat wet. It is important to keep a culvert open under the road to provide natural drainage. The small draw between fields 8 and 9 serves as a drain, and should be kept in grass to prevent erosion. It does not in any way interfere with working the two pieces as one field. The fields marked *neutral* will grow successively the crops for which they are suited, without the application of limestone.

In some areas there are deficiencies in other soil elements, such as phosphorus, potash, and rarely sulphur. These deficiencies are sometimes indicated by low yields and poor quality of crop. Soil tests have been developed for detecting these deficiencies also but are somewhat complicated and difficult to use. It would be best to depend upon the soils departments of the agricultural colleges, or upon the Soil Survey of the U.S.D.A. for information on these phases of soil deficiency.

HOW MUCH DOES THE FARM PRODUCE?

To complete the picture of the farm unit, attention should next be given to the products obtained from the fields, herds, and flocks. It is from these that support and income must be gained. Reference to the map for field numbers and acreage and

TABLE XVII—Acres of Crops, Crop Yields, and Total Production

Kind of Crop	Field No.	Acres	Normal Yield per Acre	Total Production
Oats	13	17.6	46 bu.	810 bu.
Barley	1	9.4	40 bu.	376 bu.
Oats and barley	5	9.2	54 bu.	497 bu.
Oats, barley and wheat	8, 9	22.0	36 bu.	792 bu.
Wheat	5A	5.4	18 bu.	97 nu.
Corn, for grain	6	17.2	57 bu.	980 bu.
Silage corn	7	12.6	9.0 tons	113.4 tons
Beets and potatoes	3	1.1	....	....
Alfalfa, timothy, and clover	7A	4.2	1.4 tons	5.9 tons
Alfalfa and timothy	2, 12	13.9	1.9 tons	26.4 tons
Timothy and clover	11A	.9	1.1 tons	1 ton
Reed Canary Grass *(phalaris)* (non-tillable)	11	3.7	3.4 tons	12.6 tons
Sweet clover and timothy pasture	4	19.2		
Alf. and timothy hog pasture	3	1.2		
Non-tillable pasture	10	10.8		
Farmstead	....	6.0		
Lanes, roads, and waste	....	5.4		
Total acres in farm	....	159.8		
Total small grain	....	63.6		
Total cultivated crops	....	30.9		
Total tame hay	....	19.0		
Total tillable pasture	....	20.4		
Total tillable acres	....	133.9		
Total non-tillable acres	....	25.9*		
Per cent tillable land	....	83.8		
Per cent non-tillable land	....	16.2		

*Total non-tillable acres include permanent meadow and pasture, farmstead, roads, lanes, and waste.

to the data supplied from the crop and livestock records will give the source material for building a table showing the production for the year. Records over a period of years will give a truer reflection of what may normally be produced than a one-year record. Where the long-time records are not available, the one-year record will suffice, provided it is from a representative or normal year or adjusted to what are judged to be normal yields. Pupils will have to use such records for their farm project as may be available to each. The records from the southeast Minnesota dairy farm will serve to illustrate the process. They are given in Tables XVII and XVIII.

TABLE XVIII—DAIRY PRODUCTS, HOGS, AND POULTRY PRODUCED ON SOUTHEAST MINNESOTA DAIRY FARM, 1938

Butterfat—Sales	3,908.04	
Fed in whole milk	160.00	
Used in house	186.63	
Total		4,254.67
From 18 cows =		236.4 lbs. per cow
Hogs—Sales	13,465 lbs.	
Used in house	1,050 lbs.	
Inventory increase	2,905 lbs.	
Total		17,420 lbs.
Poultry—Egg sales	2,338 dozen	
Used in house	132 dozen	
Total		2,470 dozen
From 206 hens =		143.9 eggs per hen

√ CHAPTER XIV

CHECKING THE RESULTS

It will be advisable now to study the present farm organization and production data to determine how well the farm meets the needs of the situation. Since the crops that can be grown control the type of farming that can safely be undertaken, first thought should be given to the cropping program. Are the crops raised adapted to the soil and climate? Are they of the right kind for feeding the types of livestock kept? Is the amount produced sufficient to fully support the amount of livestock kept? Must additional feed be purchased or will there be a surplus to sell? Finally, can the cropping program and the farm layout be improved? The answers to these questions must be worked out of the inventory and production statements for the farm under examination. They must be worked out one at a time. The answers to these questions applied to the southeastern Minnesota dairy farm mentioned in Chapter XIII will illustrate the nature of the study.

Are the Crops Well Adapted? Reference to the farm map, Figure 20, and to Table XVII, Chapter XIII, indicates that small grain, consisting of oats, barley, and wheat, occupies nearly one half the tillable land. These crops are all known to be generally well adapted to southeastern Minnesota. Yields of each on this farm, when grown alone, are well above the average yields of these crops for the state. This fact indicates that alone or in combination they are well adapted to the prevailing soil and physical conditions.

Are the Crops Suited to the Livestock Needs? The next step will be to consider their suitability to the kinds of stock raised. Oats, barley, and corn are all standard feeds for most kinds of livestock. Grown and fed separately or in combination they may be safely used as grain concentrates. Of the grains grown, only wheat is of doubtful nutritional and economic merit as a concentrate in animal feeding.

For feeding dairy cows there is no forage superior to well-cured alfalfa hay. There is no objection to a grass mixture with alfalfa, unless the grass is in excessive proportions and results in low yields. On this particular farm hay yields are low. The his-

tory of the hay fields should be carefully studied to learn whether the low yield is due to poor soil condition or to an unbalanced mixture of grasses and alfalfa or to deficiency in the lime content of the soil. Corn silage also is highly regarded by dairymen as a roughage feed for dairy cows. On the whole, it may be safely concluded that the grains and forages raised are well suited to the animals and products produced. But there may be differences in the relative amounts of feed nutrients produced per acre

TABLE XIX—COMPARISON OF FEED PRODUCED PER ACRE AND TOTAL DIGESTIBLE CRUDE PROTEIN AND TOTAL DIGESTIBLE NUTRIENTS PER ACRE FROM THE CROPS RAISED

Crop	Yield per Acre	Weight per Bushel Pounds	Pounds per Acre	Digestible Crude Protein* Pounds per Acre	Total Digestible Nutrients* Pounds per Acre
Oats	46.0 bu.	32	1,472	150.1	1,023
Barley	40.0 bu.	48	1,920	186.2	1,480
Oats (½)†, barley (½)†	54.0 bu.	40	2,160	213.8	1,600
Oats (⅓)†, barley (⅓)†, wheat (⅓)†	36.0 bu.	47	1,692	159.5	1,290
Wheat	18.0 bu.	60	1,080	95.0	855
Corn, for grain	57.0 bu.	56	3,192	233.0	2,601
Corn silage	9.0 tons	....	18,000	216.0	3,024
Alfalfa and timothy‡	1.9 tons	....	3,800	252.7	1,889

*Calculated from data in *Bulletin 218* (Revised June 1941), University of Minnesota Agricultural Experiment Station.
†By volume.
‡Assumed to be one-half alfalfa and one-half timothy.

that should be taken into consideration. A comparison of yields per acre in pounds of feed and total digestible nutrients per acre for the crops grown will show which ones supply the largest amounts of feed per acre and the relative quality of those produced. The comparison is made in Table XIX.

As has been previously pointed out, yields of the grains on this farm are above the average for the state. Yet the pounds of feed supplied from the small grain crops are considerably less per acre than are obtained from corn grown for grain or silage. It is less also than is supplied from an acre of alfalfa and timothy hay. In columns 5 and 6, Table XIX, comparisons are made of the digestible crude protein and total digestible nutrients per acre. The alfalfa and timothy hay lead in crude protein per acre in spite of the low yield. A yield of one ton more per acre of hay normally should be expected. If realized, it would put the hay crop more nearly in line with ear corn and corn silage, which lead in total digestible nutrients. The total crude protein and

the total digestible nutrients per acre from the corn crop are significantly larger than from the small grains. Though the yield of alfalfa and timothy hay is abnormally low, more total digestible nutrients are produced per acre from it than from the small grains alone or in combination. On a dairy farm where the income is principally from the sale of livestock and dairy products, it is probable that the income would be increased by reducing the acreage of small grain and increasing the acreage of corn and alfalfa. Certainly effort should be made also to improve the yields of hay.

Oats and barley grown alone yield less in pounds of feed and pounds of total digestible nutrients than when grown in combination. Unless grown for cash sale or some other special purpose, it would seem wise to reduce the acreage of oats and barley grown alone and increase the acreage of the combination crops.

The addition of wheat to the feed crops seems to have been of no advantage. Possibly the land on which the combination was grown was of poorer quality in which case another trial is warranted. There may be good reason for growing wheat on this farm as a cash sale crop. There is no good reason for growing it as a feed crop. The yield is about as high as can be expected over a period of years; yet, in pounds per acre of feed and of total digestible nutrients per acre, it is significantly lower than the coarse grain feed crops.

Judgment on the advisability of changing acreages of crops as now grown must be reserved until a study is made of the kind and amount of livestock kept and of the pasturage, feeds and forage required to supply their needs.

How Much Feed Is Needed? Amounts of feed and quality of feed are important considerations. A well-balanced farm will produce the major part of all feed crops needed by the livestock. It is usually wise to produce abundant pasture and forage for all livestock and buy concentrates if there is a shortage of land for the production of all feed needed. A tabulation of the acreage, yield, and total production of each crop will show how much feed is available for use or sale.

The needs of livestock for feed will vary with the breed and type kept and with the age, weight, and service performed. At this time only a rough estimate of the approximate quantity of feed needed is required to determine how well the farm supplies the needs. The total amount of feed needed can be closely esti-

mated by some simple calculations. On farms where feed records are kept, the amount can be calculated closely. Where the farm is included in a cow-testing association, feed records for the milk cows at least will be available. Amounts for other animals can be closely estimated. From the statement of livestock on the farm being studied, determine the number of each kind of animals kept. Multiply the estimated or calculated amounts of feed of each

TABLE XX—ACREAGE, YIELDS, AND TOTAL PRODUCTION OF EACH CROP AND AMOUNT AVAILABLE FOR USE OR SALE ON THE SOUTHEAST MINNESOTA DAIRY FARM

Crop	Acres	Yield per Acre	Total from Farm		Reserved for Seed	Available for Use or Sale Pounds
			Bushels or Tons	Pounds		
Oats	17.6	46	810	25,920	2,362*	23,558
Barley	9.4	40	376	18,048	2,050*	15,998
Oats and barley	9.2	54	497	19,880	....	19,880
Oats, barley, and wheat	22.0	36	792	37,224	....	37,224
Wheat	5.4	18	97	5,820	600*	5,220
Corn, for grain	17.2	57	980	54,880	....	54,880
Silage corn	12.6	9.0	113.4	226,800	....	226,800
Alfalfa and timothy	13.9	1.9	26.4	52,800	....	52,800
Alfalfa, timothy, and clover	4.2	1.4	5.9	11,800	....	11,800
Timothy and clover	.9	1.1	1.0	2,000	....	2,000
Reed Canary Grass *(phalaris)*	3.7	3.4	12.6	25,200	....	25,200
Non-tillable pasture	10.8	1 cow per 2 acres = 5.4 cows				
Tillable pasture	20.4	1 cow per ¾ acre = 27.2 cows				
Total	147.3					

*Including seed for oats, barley, and wheat mixtures.

kind required per head by each class of livestock by the number of head kept of that class. Sum up the items to show the total needed of each, concentrates and roughage. On farms where no records are available, an approximation may be made by the use of figures selected from Table XXI, which gives the range within which animals are usually fed. These ranges will serve as guides in making the estimates. Either extreme, or some figure in between, which, in the judgment of the operator, more closely fits the case, may be used. The age, condition, and weight of each animal must be taken into consideration in making the estimate. The work performed or the product yielded also must be taken into account for each class of animal. An estimate of this kind is illustrated in Table XXI.

The information as to quantities of feed used in livestock production as presented in Table XXI is based on records of feed

consumption on a large number of farms in Minnesota. In general these are well-managed farms and represent a fair standard of accomplishment under farm conditions. The concentrates include farm grains, mill feeds, commercial mixed feeds, and protein concentrates. The quality of the rations used was equal to

TABLE XXI—APPROXIMATE AMOUNTS OF CONCENTRATES AND ROUGHAGE USED IN LIVESTOCK PRODUCTION IN MINNESOTA * †

Class of Livestock	Concentrates‡ Range—Pounds	Dry Roughage§ Range—Pounds
Work horse, light to moderate work	800—2000	3000—5000
Work horse, moderate to heavy work	2000—3000	4000—6000
Colt, under 3 years	750—1500	2500—3500
Dairy cow—150 lb. butterfat	1200—1600	6000—7000
200 lb. "	1500—1900	6000—7000
250 lb. "	1800—2300	6000—7000
300 lb. "	2200—2700	6000—7000
350 lb. "	2600—3200	6500—7500
400 lb. "	3100—3800	6500—7500
Dairy heifer, 2 years old	500— 700	4000—5000
" " , 1 year old	500— 700	2000—3000
" " , calf	300— 400	1000—1500
Dairy or beef bull (not on pasture)	1200—1500	5000—6000
Beef cow or 2 years old	....	5000—6000
Beef heifer, yearling	....	2000—3000
Beef calf	300— 400	1000—1500
Feeder cattle (per 100 lb. gain)	550— 850	350— 600
Ewe	50— 125	400— 800
Farm flock of sheep—per ewe	100— 150	450— 550
Feeder lambs (per 100 lb. gain)	600— 800	400— 550
Hogs per 100 lb. gain in weight (Includes feed for sows and boar)	450— 550	....
Farm poultry flock—per laying hen	95— 130	....
Laying hen, only	75— 90	....
Pullet to 6 months	25— 35	....
Broilers or roasters—per 100 lb.	450— 600	....
Turkey—per 100 lb.‖	500— 600	....

*All data on an annual basis unless otherwise specified.

†In addition to the concentrates and roughages listed it is assumed that pasture consuming animals will be pastured for the usual pasture season. Of good quality pasture, such as sweet clover, lowland bluegrass, alfalfa, or rape for hogs, allow 1 acre for 1 to 2 cows, 1 acre for 3 to 5 head of young stock, 1 acre for 6 ewes and their lambs, 1 acre for 5 sows and their litters. Of upland bluegrass pasture, allow twice as many acres as the above.

‡Skimmilk is included with concentrates. Ten pounds of skimmilk is considered the equivalent of one pound of concentrates.

§Silage may be substituted for dry roughage at the rate of 3 pounds of silage to 1 pound dry roughage up to approximately one-half of the total roughage ration.

‖Feed for breeding stock not included.

or perhaps somewhat better than that used by the average farmer. In general the quantities of feed used are larger than usually reported in feeding experiments or recommended in feeding standards. No allowance is made for feed used by animals which die before reaching market as is common in experimental prac-

tice. In feeding experiments fairly uniform as well as fairly high quality feeds are used and any feed not consumed is weighed and deducted from that charged to the livestock. Under farm conditions feed varies widely in quality, and in the case of low quality grains such as soft corn a much larger quantity must be used than if good quality concentrates were available. Often roughage is fed in such quantities that the livestock pick it over, consume the

TABLE XXII—ESTIMATED FEED REQUIREMENTS FOR A YEAR FOR LIVESTOCK KEPT ON SOUTHEAST MINNESOTA DAIRY FARM

Livestock Kept	Estimated Amounts Fed per Unit				Total Fed on Farm		
Class	Number Units	Corn, Grain, and other Concentrates Pounds	Hay or Equivalent Pounds	Silage Pounds	Concentrates	Hay	Silage
Work horses	7 head	2,400	4,000	....	16,800	28,000	....
Colts	1 "	800	4,000	....	800	4,000	....
Cows, milking	18 "	1,400	2,850	9,000	25,200	51,300	162,000
Heifers, 2 years	3 "	500	3,000	4,500	1,500	9,000	13,500
Heifers, 1 year	3 "	500	1,500	3,000	1,500	4,500	9,000
Calves, under 1 year	5 "	300	800	600	1,500	4,000	3,000
Hogs produced	174 cwt.	450	....	....	78,300	....	....
Hens	200 birds	75	....	....	15,000	....	....
Chickens raised to 6 mo.	300 "	25	....	....	7,500	....	....
Fed					151,700	100,800	187,500
Raised					156,760	91,800	226,800
Balance for use or sale					5,060	—9,000	39,300

This Table illustrates a method of determining the approximate amounts of the different groups of animals and the total feed that will be needed to support all the livestock. A comparison of these amounts with the amounts produced on the farm will show how well balanced the crop and livestock production programs are. It will show in advance of needs the amounts there will be left for sale. Such knowledge will enable the operator to buy to advantage or to sell when prices are favorable.

better portions, and the rest is thrown out as bedding. This is the farmer's way of utilizing low quality feed without sacrificing production. The range in concentrate feeding for roughage-consuming animals is generally somewhat higher than for concentrate consumers since the proportion of roughage and concentrates in the ration may be varied within fairly wide limits. These feed quantities are based on harvested yields and are therefore adapted to checking against quantities of feed produced. In actual practice there is more or less shrinkage, spoilage, and mechanical loss

on most farms. This fact accounts for part of the excess of these figures over experimental results.

Similar information based on farm feed records is available from the agricultural experiment stations and extension services in most states. Quantities of feed for livestock production vary somewhat in different parts of a state or from state to state because of differences in the kinds and quality of feed available, feeding practices, climatic conditions, the length of the pasture season, and the quality of pasturage available. Where feed records are not available for a particular farm, information on rates of feed consumption should be from sources where conditions are similar to those on the farm under consideration.

WHAT TABLE XXII SHOWS. The summary of Table XXII shows that this farm produced 5,060 pounds more of concentrates than was fed. It will be remembered that the wheat crop was included with the other concentrates as a feed crop in Table XIX, notwithstanding the fact that wheat is not primarily a grain feed and is seldom fed alone. Since it is not primarily a feed crop, it would be advisable to sell all the wheat as a cash crop. There is a deficit of 4½ tons of hay and a surplus of 11½ tons of silage. These practically offset each other and by increasing slightly the rate of silage feeding and decreasing the rate of hay feeding the feed pattern balances with the amounts of livestock maintained. In actual farm practice there is usually a carry-over of some kinds of feed from one year to another and a decrease in the inventories of other feeds, so it is not always necessary to change the rate of using a particular kind of feed that may be below normal supply in a particular year. There appears to be feed enough on this farm for the livestock kept. It may, however, be possible to materially increase the income from the farm by shifting more land to the heavier yielding feed crops and hay in support of more livestock.

If more cows are added, will it be necessary to employ more help? On a diversified stock farm such as this, ten to twelve cows per man is the usual load where hand milking is done. Where a machine is used, one man can care for fifteen to twenty head without difficulty. The present stock of cows, eighteen in number, gives hardly full employment to two men. Yet there are three men on this farm and a milking machine is used. The available labor supply indicates that the herd may well be increased to twenty-five or thirty cows at least. The farm could easily be made to produce feed for the extra cows and the labor maintained is

sufficient to care for them. If barn room can be provided, therefore, it would seem advisable to increase the number of cows.

Consideration should be given also to the advisability of increasing the number of brood sows kept and the hogs marketed.

How Much Pasture is Needed? The estimates made of feed requirements are based on a two-hundred-day feeding season. For the balance of the year the livestock should be supported on good pastures of grasses and legumes, supplemented by light grain feeding where heavy production is desired. Pasture crops afford not only cheap feed but good sanitary conditions for the livestock as well. The labor of caring for the livestock is much less, also, while feeding on pastures. As a matter of good economy and increasing the farm income, therefore, it is wise to provide ample pasturage for all animals that can be kept on pasture feeds. Reference to Table XVII shows that, on the farm used in this study, there were 10.8 acres of non-tillable or permanent pasture land. This land produces native bluegrasses with some mixtures of other grasses and small white clover. Such land furnishes good pasture during the early part of the season but affords very little during the hot summer season. Pasture of this kind requires two acres per cow, or equivalent, for summer pasture. There were 20.4 acres of tillable land pasture, composed of timothy, alfalfa, and clover. Three fourths of an acre of such land should care for one cow. See Table XX.

The livestock statement shows that there were 8 horses, 18 cows, 1 bull, 14 young cattle, 1 boar, and 7 sows for which pasture should be supplied. On the basis of pasture allowances indicated in pasture footnote, Table XXI, there is barely sufficient pasture on this farm to carry the livestock kept. Should additional cows or other livestock be added, it will be advisable to increase pasture land in proportion to the number of head added. Such pasture land could well come from the lighter yielding small grain crops.

Other Checks on Organization. The study of efficiency of organization will not be complete until the use made of available labor is checked and note made of the earnings from the farm.

There is much loss of labor on most farms. This loss may be due to inefficient organization or to poor management. Poorly shaped and inaccessible fields often result in loss of time in working the fields and in going to and from work. Poorly arranged or badly located buildings consume much time and reduce the profits from operation. The use of poorly adapted tools and implements may also lead to loss of time and poor quality of work.

Delayed tillage or other operation may greatly increase the time required to care for or harvest a crop. These points must all be taken into consideration in judging the efficiency of organization.

Farmers do not, as a rule, observe regular hours in doing their farm work. There are periods at seeding and harvest time particularly when the day's work is long and hard. There are other seasons on most farms where pressure is not great and the day's work is short and comparatively light. At no time, however, is there entire freedom from responsibility or from "chore" work in caring for animals or property. So-called "chores" require the presence of some workers on Sundays and holidays as well as on the regular workdays of the week. The normal work load is, therefore, hard to judge. Summaries of labor records from many farms, however, lead to the conclusion that 3,000 to 3,600 hours of labor yearly may normally be expected from each adult farm worker. At least 80 per cent of the time of labor should be spent on the farm enterprises that yield products for use or sale. Care of the grounds and buildings and general upkeep will absorb the other 20 per cent.

On the southeastern Minnesota dairy farm which has thus far been used as a study of farm organization, there is a plentiful supply of labor. In addition to the farm operator, three sons are at home. One of these is capable of doing a man's work. The other two furnish the equivalent of an additional man. There are, therefore, three men available who, on full time, should give a total of 9,000 to 10,800 hours of services to the farm per year. Judging by the number of cows kept and the acres of crops raised, this farm should be satisfactorily operated by two full-time men. Since all farm work is done by members of the family, there is no cash loss from maintaining the extra help, but the operator's labor income would be increased if the labor were used more efficiently.

The efficiency of organization of a farm is indicated to some extent by the earnings from it. A farm poorly organized, however, may yield a high income because of superior operating management. The southeastern Minnesota dairy farm under consideration had a cash income of $3,842. In addition, produce used in the house was valued at $287, making a total gross income of $4,129. The total cash expense for operating was $1,761, plus $65, decrease in the farm inventory, or a total of $1,826. The difference between gross income and operating expense is $2,303. This amount is the joint earnings of the capital invested and

the family labor. Interest on the investment amounted to $743, thus leaving $1,560 as the earnings of the family labor. The work of the family, other than the operator, charged against the farm at what it would have earned had the work been done for others was $1,452. Deducting this from the family labor earnings, shows the operator had only $108 left for his own labor. This is further evidence that the available labor was either not fully employed on productive enterprises or that it was not efficiently directed.

The yields of grain, on the whole, are satisfactory, although the adoption of crop rotation would in all probability increase the productive power of the land. Yields of hay are lower than they should be. The production from the cows and poultry is fair, but undoubtedly can be increased by careful testing and culling of the herds and flocks. The introduction of more alfalfa hay into the roughage ration, as a substitute for corn stover and a part of the silage would probably improve the production.

(The conclusions reached through this analysis are (1) that the capital is not well distributed; (2) that the field arrangement and the farm layout can be improved; (3) that some alterations in the cropping plans are advisable; (4) that the labor is not fully employed; (5) that more intensive farming and more effective direction of labor will result in larger operator's labor earnings.)

CHAPTER XV

IMPROVING THE ORGANIZATION

Few farms are so well organized that no improvement can be made. Almost anyone who makes a study of his home farm or of the farms of neighbors will find many of them out of balance in some respect. In most instances, improvements in organization can be suggested that may be made at little expense. In others the difficulties may be so great as to make it advisable to attempt only minor changes in layout or equipment.

Usually improvements can be made in the field arrangement or in cropping plans. Attempts to move or to rebuild farmsteads may be undertaken only in rare instances where but little building has been done or where financial resources of the owner are so ample that operating activities will not be limited by the outlay. Adjustments in livestock quantities or kinds and in equipment and machinery can be made without undue cost, as the need arises. In any event, a careful study of possibilities is desirable and should result in at least some savings in time or expense of operation. A further study of the southeastern Minnesota dairy farm will furnish illustrations of farm reorganization.

Improving the Farm Layout. No attempt will be made to reorganize the farmstead. The buildings have been long established with groves and windbreaks, suitably arranged. The house is more expensive than is really needed to comfortably house and care for the labor necessary to operate the farm. The capital investment in the house should be charged down to what it is worth in service to the farm, or charged in part to the operator, as a personal expense. The farm, as a business enterprise, would thus be relieved of an excessive interest charge. The operator's labor earnings would be increased in like amount.

Attention is again called to the numerous small fields shown on the base map. There is no evidence on the map that a crop rotation is being followed. In fact, it would be difficult to establish a crop rotation without rearrangement of the fields. Examination shows that this would not be especially difficult. All the land is tillable, except that in field "10," which is in permanent

pasture, and field "11," which, because of excessive moisture, is in Reed Canary Grass for hay and pasture. There are no obstacles to field rearrangement except the farmstead, which is not to be disturbed and must be worked around. Fortunately, it is so located as to make access to all fields easy and distances to fields short, both factors that lead to economy in operation. The lanes leading to the fields need to be changed but little.

In making new field plans, consideration should be given to the matter of providing for a good crop rotation system, which will not only supply the production needed but will maintain or increase the fertility of the soil. Reference to Table XVII, Chapter XIII, shows that the crops now grown are small grain, 63.6 acres; cultivated crops, 30.9 acres; tame hay, 19 acres; and tillable pasture crops, 20.4 acres. This is a total of 133.9 acres. The wisdom of reducing the small grain acreage and of increasing the acreage of hay has been suggested. The tillable pasture land may well be increased also. A minor rotation of three or four fields near the barnyards will also be desirable for the accommodation of calves, pigs, and other small animals during the pasture season.

A study of the farm shows that it would be possible to redivide the tillable land into five equal-sized fields of a little over twenty five acres each and also to provide for three minor rotation fields of two acres each, nearer the buildings. The suggested field layout is shown on the reorganization map, Figure 22.

THE NEW CROPPING PLAN. In establishing crop rotations it is advisable to have one field for each year in the rotation. The five large fields, therefore, lend themselves to a five-year rotation, and the three small fields to a three-year rotation. In this instance a major rotation is suggested of

First year—Small grain (oats and barley mixed, for feed).

Second year—Small grain (oats and barley mixed, for feed. Seeded to timothy and sweet clover).

Third year—Pasture (timothy and sweet clover). Manured and plowed in late fall or early spring for corn.

Fourth year—Cultivated crops (corn for ears and silage or soybeans for forage).

The above rotation occupies only four of the five large fields. The fifth one will be seeded to alfalfa for hay and left in alfalfa as long as the stand is good. When it fails, or perhaps once in four or five years, some other of the major fields will be seeded to alfalfa and the old alfalfa field plowed up and dropped into the rotation. By following this plan, the benefits from the growth

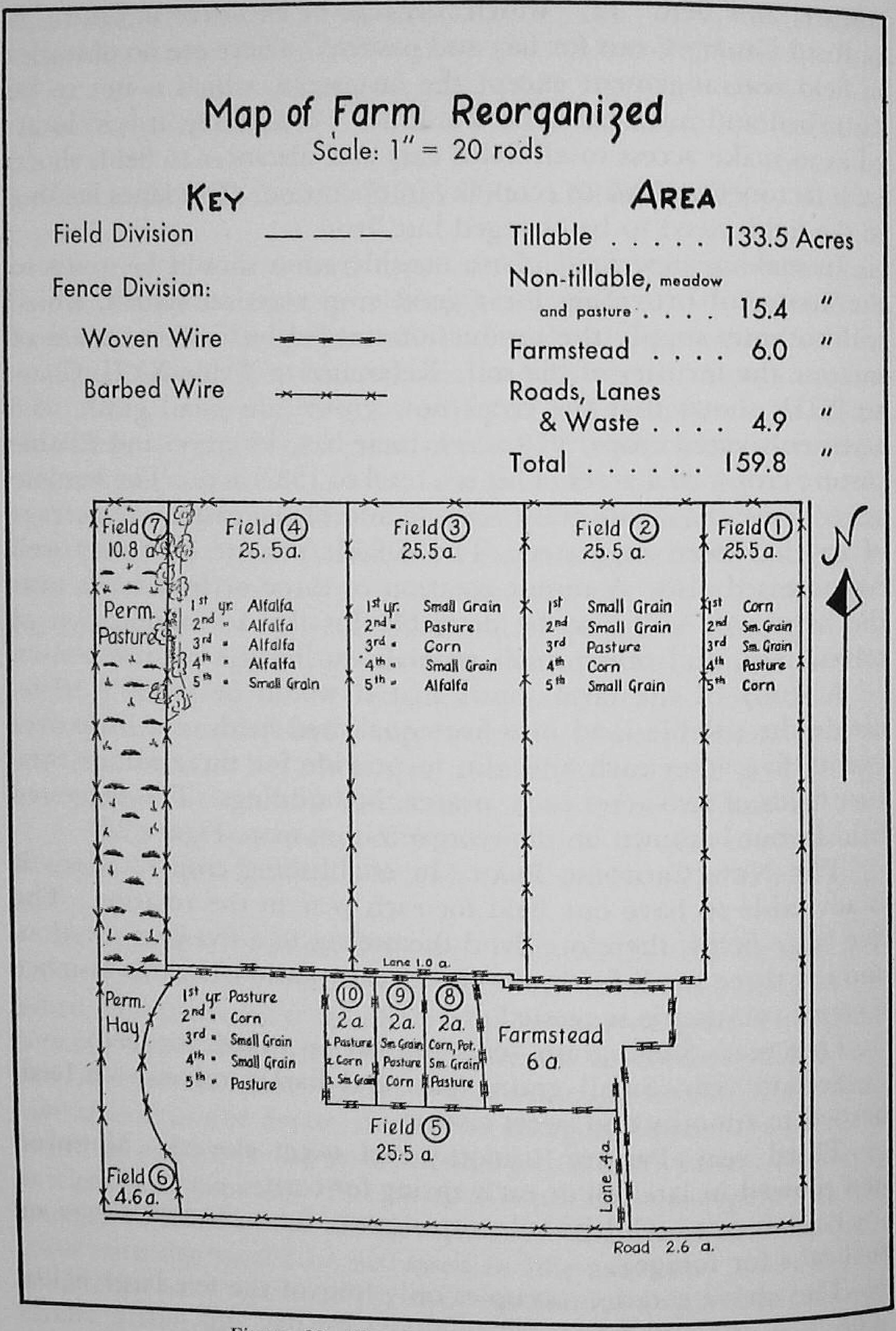

Figure 22. Plan for the reorganized farm.*

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*Rarely can a reorganized farm plan be put into effect in one year. Two to four or five years may be required to bring the fields into the adopted rotation. A transition plan showing changes contemplated from year to year may be helpful in making the changes required.

of the legume crop, alfalfa, will be passed on to each field in turn until the whole farm has been covered. The sweet clover pasture, also a legume crop, will pass around the farm in four years.

The minor rotation occupies the three small fields and will consist of:

First year—Small grain (seeded to clover, alfalfa and timothy).

Second year—Pasture (clover, alfalfa, and timothy, for hogs, calves, etc.).

Third year—Cultivated crop (corn or other cultivated crop).

The order in which the crops will be grown in the major and minor rotations over a five-year period is clearly shown in Table XXIII.

TABLE XXIII—Order by Years, of Crops Grown in Rotation

Field No.	Crop				
	1947	1948	1949	1950	1951
1	Corn	Small grains	Small grains*	Pasture†	Corn
2	Small grains	Small grains*	Pasture†	Corn	Small grains
3	Small grains*	Pasture†	Corn	Small grains‡	Alfalfa
4	Alfalfa	Alfalfa	Alfalfa	Alfalfa§	Small grains
5	Pasture†	Corn	Small grains	Small grains*	Pasture†
6	Reed Canary	Reed Canary	Reed Canary	Reed Canary	Reed Canary
7	Upland pasture	Upland pasture	Upland pasture	Upland pasture	Upland pasture
8	Cultivated crops	Small grains*	Pasture	Cultivated crops	Small grains*
9	Small grains*	Pasture	Cultivated crops	Small grains*	Pasture
10	Pasture	Cultivated crops	Small grains*	Pasture	Cultivated Crops

*Seeded to sweet clover 12 pounds, timothy 4 pounds an acre, alfalfa or other pasture crops.
†Manure applied and plowed in late fall or early spring.
‡Seeded to alfalfa 12 pounds, timothy 2 pounds an acre, or other pasture crops.
§Plowed in fall.

Production Under the Reorganized Plan. In reorganizing the farm layout, changes have been made not only in the size and shape of fields, but in the acreages of crops grown, as well. Wheat has been dropped out altogether. The small amount that was grown was not of much consequence as a sale crop. While wheat may have a place in the grain rations of chickens, swine, and dairy cows, the yield of digestible nutrients per acre is much less than that of other grain. It will be advisable to buy the small quantities needed rather than to use land for its production that will yield more feed in other crops.

The total acreage of small grain has been reduced and the acreage of alfalfa hay and of tillable pasturage increased, with a view to increasing the dairy herd by 8 to 10 head. Corn for grain and silage has been slightly reduced in acreage. A slight

addition has been made to the Reed Canary Grass, to bring all low land into a permanent hay crop. It should be understood that this land may be used for pasture at any time that more pasture is needed for the livestock kept. Hay from the other fields will be ample for all needs. Yields of all crops have been left as under the old plan, except that the yield of alfalfa hay was raised one

TABLE XXIV—ACREAGE, YIELD, AND TOTAL PRODUCTION OF EACH CROP AND AMOUNT AVAILABLE FOR USE OR SALE UNDER THE REORGANIZED PLAN OF THE SOUTHEASTERN MINNESOTA DAIRY FARM

Crop	Acres	Yield per Acre	Total		Reserved for Seed Pounds	Available for Use or Sale Pounds
			Bushels or Tons	Pounds		
Oats and barley........	53.0	54 bu.	2,862 bu.	114,480	4,664	109,816
Corn, for grain.........	15.5	57 bu.	884 bu.	49,504	....	49,504
Silage corn............	12.0	9 tons	108 tons	216,000	....	216,000
Alfalfa...............	25.5	2 tons	51 tons	102,000	....	102,000
Reed Canary grass.....	4.6	3.4 tons	15.6 tons	31,200	....	31,200
Non-tillable pasture....	10.8	1 cow per 2 acres = 5.4 cows				
Tillable pasture........	27.5	1 cow per ¾ acre = 36.7 cows				

tenth of a ton per acre. Even at two tons per acre the yield of alfalfa hay is abnormally low. It is probable that yields of all crops under the rotation plan will eventually increase somewhat as the soil improves under the new tillage practices. The result of the reorganization, as reflected in production is clearly shown in Table XXIV.

GAINS AND LOSSES FROM REORGANIZATION. Under the new layout, the fields have been made more readily accessible from the farmstead. One lane has been eliminated, thus saving land and fencing. The fields are approximately of the same size and more regular in size. The field arrangement now permits cropping under rotation in regular and systematic manner. A free use of legumes in the pasture and hay crops, together with the barnyard manures available, will eventually result in greater productive power from the soil.

The total production of concentrates is slightly greater than under the old plan (see Table XXV). There is also a large increase in hay production and a small decrease in silage. Since there was already an excess of silage over feeding requirements as shown in Table XXII, this decrease is not significant. The net increase in feed measured in terms of total digestible nutrients is 12 per cent. However, the improvement in the quality of the

feed is even more important than the increase in quantity. There is an increase of 34 per cent in the production of digestible crude protein. This is highly significant in view of the fact that protein is the one element most likely to be deficient in livestock rations and is usually the most expensive if it must be purchased.

The additional feed available under the revised cropping plan

TABLE XXV—SUMMARY OF CROP PRODUCTION UNDER THE NEW AND OLD CROP PRODUCTION PLANS

	Concentrates Pounds	Hay Pounds	Silage Pounds	Pasture Head
New Plan	159,320	133,200	216,000	42.1
Old Plan	156,760	91,800	226,800	32.6
Gain or Loss	+2,560	+41,400	−10,800	+9.5

	Digestible Crude Protein Pounds	Total Digestible Nutrients Pounds
New Plan	29,788	232,135
Old Plan	22,312	207,709
Increase—pounds	7,476	24,426
Increase—percentage	+34%	+12%

would be ample for five additional cows. There would be ample concentrates and by increasing the proportion of hay relative to silage the roughage would also be sufficient. There would also be plenty of pasture. Since the overhead expense would not be increased materially and as labor is available to care for more cows, this addition to the dairy herd would probably result in an increased net income to the operator.

A fairly complete view now has been attained of the procedure to be used in studying a farm business and in determining whether or not it is operated under a well-balanced organization plan. Continual study of this question is needed in connection with most farms in order to maintain an efficient operating unit. If full knowledge of the farm business is to be obtained, careful and systematic records of all activities must be kept. The records made of the year's activities as a supplementary study will become the basis of studying the operating problems in the next year's work.

CHAPTER XVI

BUDGETING A FARM BUSINESS

(The farm budget is one of the most useful planning devices available to the farm manager in setting up and checking a farm organization. Its use has been illustrated in previous chapters but its value to the farm manager is so great that it merits further elaboration. All constructive planning of a farm organization involves the use of the budgeting method. Disappointment and financial loss can be avoided by first testing future plans by the budgeting method rather than by actual operation. It is much cheaper to make mistakes on paper than in practice.)

(In its simplest form a budget is a plan for future using or spending. A farm budget is a plan for the future use of land, labor, power, equipment, and other resources of the farmer. It may be used to determine the probable income that may be expected from a farm. The farmer who is considering the purchase of a farm is interested in determining whether the probable income will be sufficient to pay operating expenses, liquidate any indebtedness involved, and leave a sufficient margin to provide a satisfactory standard of living for his family. Most systems of farm appraisal involve a budgeting of future income and expense in computing the net income to be capitalized into the productive value of the farm. The prospective farm purchaser may be interested in comparing the prospective income from a farm with the income he may expect from some alternative use of his labor and capital. A budget can be used (1) to set up a new farm business, (2) to compare alternate plans of organization for a going farm business, (3) to compare two or more competing lines of production and (4) to compare alternate methods of production or the returns from alternative investments.)

Information Needed for a Farm Budget. A farm budget is no better than the information upon which it is based. To use the budget method effectively one must know the kind and quality of resources available. He must also know the kind and quantity of labor, power, and production goods required for production of the crops and livestock under consideration. The farmer who has adequate farm records of his farm operations in previous years

addition has been made to the Reed Canary Grass, to bring all low land into a permanent hay crop. It should be understood that this land may be used for pasture at any time that more pasture is needed for the livestock kept. Hay from the other fields will be ample for all needs. Yields of all crops have been left as under the old plan, except that the yield of alfalfa hay was raised one

TABLE XXIV—ACREAGE, YIELD, AND TOTAL PRODUCTION OF EACH CROP AND AMOUNT AVAILABLE FOR USE OR SALE UNDER THE REORGANIZED PLAN OF THE SOUTHEASTERN MINNESOTA DAIRY FARM

Crop	Acres	Yield per Acre	Total		Reserved for Seed Pounds	Available for Use or Sale Pounds
			Bushels or Tons	Pounds		
Oats and barley	53.0	54 bu.	2,862 bu.	114,480	4,664	109,816
Corn, for grain	15.5	57 bu.	884 bu.	49,504	....	49,504
Silage corn	12.0	9 tons	108 tons	216,000	....	216,000
Alfalfa	25.5	2 tons	51 tons	102,000	....	102,000
Reed Canary grass	4.6	3.4 tons	15.6 tons	31,200	....	31,200
Non-tillable pasture	10.8	1 cow per 2 acres = 5.4 cows				
Tillable pasture	27.5	1 cow per ¾ acre = 36.7 cows				

tenth of a ton per acre. Even at two tons per acre the yield of alfalfa hay is abnormally low. It is probable that yields of all crops under the rotation plan will eventually increase somewhat as the soil improves under the new tillage practices. The result of the reorganization, as reflected in production is clearly shown in Table XXIV.

GAINS AND LOSSES FROM REORGANIZATION. Under the new layout, the fields have been made more readily accessible from the farmstead. One lane has been eliminated, thus saving land and fencing. The fields are approximately of the same size and more regular in size. The field arrangement now permits cropping under rotation in regular and systematic manner. A free use of legumes in the pasture and hay crops, together with the barnyard manures available, will eventually result in greater productive power from the soil.

The total production of concentrates is slightly greater than under the old plan (see Table XXV). There is also a large increase in hay production and a small decrease in silage. Since there was already an excess of silage over feeding requirements as shown in Table XXII, this decrease is not significant. The net increase in feed measured in terms of total digestible nutrients is 12 per cent. However, the improvement in the quality of the

Prices received by farmers. — Tobacco produced on fairly level farms brought a higher price than that produced on rolling-land farms (Table 6). For other crop and livestock items the prices were about the same. Some difference was noted in price received on small and on large farms, but this difference is not shown because of lack of conclusive data. The differences were usually for items where quality of product is especially important, such as tobacco, lambs, and beef cattle.

Prices paid by farmers. — The prices paid by farmers in the Pennyroyal were fairly uniform regardless of the land class or the size of farm. Seed, feed, and feeder-livestock prices varied some from year to year, but labor costs and costs for varied services were fairly constant (Table 7).

TABLE 4—Production Requirements and Direct Cash Costs per Acre for Crops Grown on Farms with Level to Undulating Land and on Farms with Rolling to Steep Land, Pennyroyal Area, Kentucky

(Based on usual accomplishments in the Pennyroyal area.)

	Level to undulating land	Rolling to steep land
Corn for grain, per acre		
Seed, pounds	7	7
Fertilizer,[1] pounds	..	75
Man labor, hours		
From standing stalk	17	18
From shock	27	28
YIELD		
grain, bushels	37	34
stover, pounds	2000	1900
Burley tobacco, per acre		
Plant bed		
Seed, ounce	⅛	⅛
Cotton, yards	10	10
Sterilization	$1.25	$1.25
Fertilizer, pounds	60	60
Treatment	$0.10	$0.10
Fertilizer,[1] pounds	120	160
Fertilizer (complete)[3] pounds	75	55
Lead arsenate, pounds	10	10
Man labor, hours	335	335
YIELD, pounds	1060	980
Wheat for grain, per acre		
Seed, bushels	1.25	1.25
Fertilizer,[1] pounds	175	145
Twine, pounds	2	1.5
Harvesting methods		
Cutting[4]	$0.85	$0.85
Threshing[4]	$1.08	$0.96
Combining	$2.50	$2.50
Marketing	$0.42	$0.40
Man labor,[5] hours	9	9
YIELD, bushels	18	16
Dark air-cured tobacco, per acre		
Plant bed		
Seed, ounce	⅛	⅛
Cotton, yards	10	10
Sterilization	$1.25	$1.25
Fertilizer, pounds	16	16
Treatment	$0.10	$0.10
Fertilizer,[1] pounds	125	125
Fertilizer (complete)[3] pounds	150	..
Lead arsenate, pounds	10	10
Man labor, hours	226	226
YIELD, pounds	1130	980

	Level to undulating land	Rolling to steep land
Corn for silage, per acre		
Seed, pounds	12	12
Fertilizer,[1] pounds	..	50
Rent on ensilage cutter[3]	$2.25	$2.25
Man labor, hours	33	38
YIELD, tons	7	5.7
Barley for grain, per acre		
Seed, bushels	2	2
Fertilizer,[1] pounds	125	125
Twine, pounds	2.25	2
Harvesting methods:		
Contract cutting[4]	$0.85	$0.85
Threshing[4]	$1.20	$1.20
Combining	$2.50	$2.50
Man labor,[5] hours	9	9
YIELD, bushels	24	24
Oats for grain, per acre		
Seed, bushels	1.5	1.5
Fertilizer,[1] pounds	100	100
Twine, pounds	2.25	2
Harvesting methods:		
Contract cutting[4]	$0.85	$0.85
Threshing[4]	$1.55	$1.25
Combining	$2.50	$2.50
Man labor,[5] hours	9	9
YIELD, bushels	31	25
Small grain for pasture, per acre		
Seed, bushels	1.75	1.75
Man labor, hours	4	4
Red clover for hay, per acre		
Seed,[7] pounds	8	8
Man labor, hours	10	10
YIELD, tons	1.5	1.3
Soybeans for grain, per acre		
Seed, bushels	1	1
Fertilizer, pounds	100	100
Combining	$3.00	$3.00
Man labor, hours	9	10
YIELD, bushels	15	12

(Continued on page 201)

TABLE 4—(*Continued*)

	Level to undulating land	Rolling to steep land
Dark fire-cured tobacco, per acre		
Plant bed	1/8	1/8
Seed, ounces		
Cotton, yards	10	10
Sterilization	$1.25	$1.25
Fertilizer, pounds	35	35
Treatment	$0.10	$0.10
Fertilizer,[1] pounds	200	200
Fertilizer (complete)[3] pounds	80	80
Lead arsenate, pounds	10	10
Sawdust, load	1	1
Man labor, hours	256	256
YIELD, pounds	1025	990
Grasses for hay, per acre		
Seed,[7] pounds	5½	5½
Man labor, hours	7	7
YIELD, tons	.9	.7
Lespedeza for seed, per acre		
Seed,[7] pounds	20	20
Harvesting	$2.60	$2.60
Man labor, hours	2	2
YIELD, pounds	260	200
Crimson clover seed, per acre		
Seed, pounds	15	15
Fertilizer, pounds	100	100
Harvesting	$6.25	$5.00
Man labor, hours	9	9
YIELD, bushels	2.5	2

	Level to undulating land	Rolling to steep land
Soybeans for hay, per acre		
Seed, bushels	1	1
Man labor, hours	17	17
YIELD, tons	1.5	1.3
Alfalfa for hay, per acre		
Seed,[6] pounds	15	15
Fertilizer,[1] pounds	250	200
Limestone, tons	2	2
Man labor, hours	20	20
YIELD, tons	2.5	2.25
Lespedeza for hay, per acre		
Seed,[7] pounds	20	20
Man labor, hours	9	9
YIELD, tons	1.2	1.0
Red clover for seed, per acre		
Seed,[7] pounds	8	8
Harvesting	$2.10	$1.65
Man labor, hours	4	4
YIELD, bushels	1.4	1.1
Mixed hay, per acre		
Seed,[7] pounds	20	20
Man labor, hours	10	10
YIELD, tons	1.2	1.1
Amendments, per tillable acre		
Limestone, pounds	214	214
AAA phosphate,[8] pounds	11	11

1 Fertilizer rates in terms of 20 per cent superphosphate. 2 Machine charge only. Most of these farmers own cutters. 3 Most of the farmers reported use of 3-8-6 for the complete fertilizer. Next in importance were 4-8-6 and 4-12-8. 4 Machine charge only when hired. 5 For grain cut and threshed. If harvested with a combine use 6 hours per acre. 6 Several farmers on the farms studied sowed grass with alfalfa, usually orchard grass. 7 Usually seeded with another legume or grass. Mixtures were (a) red clover, 8 lbs., orchard grass, 7 lbs.; (b) lespedeza, 15 lbs., redtop, 4 lbs.; (c) lespedeza, 20 lbs., sweet clover, 10 lbs., and (d) redtop, 6 lbs., orchard grass, 7 lbs. 8 Does not include AAA phosphate applied to alfalfa, and is based upon 20 per cent superphosphate.

TABLE 5—PRODUCTION REQUIREMENTS AND CASH COSTS PER HEAD OF LIVESTOCK, PENNYROYAL AREA, KENTUCKY

(Based on usual accomplishments in the Pennyroyal area.)

Dairy cows, semicommercial herds, per cow	
Corn or equivalent, bushels	25
Cottonseed meal, 40%, pounds	40
Legume hay, tons	1½
Pasture,[1] acres	3
Veterinary cost	$1.00
Whole milk for veal, pounds	900
Man labor, hours	130
PRODUCTION	
Total whole milk, pounds	4000
Butterfat, pounds	(180)
Veal,[2] pounds	150
Dairy cows, commercial herds, per cow	
Corn or equivalent, bushels	33
Cottonseed meal, 40%, pounds	60
Legume hay, tons	2.25
Pasture,[1] acres	3
Veterinary cost	$1.25
Whole milk for veal, pounds	800
Man labor, hours	140

Fattening feeder pigs, per pig	
Corn, bushels	8
Tankage, pounds	8
Pasture, acre	0.1
Miscellaneous costs	0.02
Man labor, hours	5
PRODUCTION, pounds	100
Beef cows producing fat calves, per cow	
Corn, bushels	9
Legume hay, tons	1
Other roughage, tons	1
Pasture, acres	3
Man labor, hours	15
Miscellaneous costs,[4]	$0.35
PRODUCTION,[5]	
Calf,[6] pounds	400
Feeders, per 100 pounds gain (Purchased or weaned in fall and sold 10 months later.[7])	
Corn, bushels	6.8
Cottonseed meal, pounds	30

(Continued on page 202)

TABLE 5—*(Continued)*

Dairy cows, commercial herds, per cow—(Cont'd)	
PRODUCTION	
Total whole milk, pounds	5500
Butterfat, pounds	247
Veal,[2] pounds	140
Dairy calves, per calf	
Corn, bushels	1
Mill feed, pounds	20
Skimmilk, pounds	1500
Legume hay, pounds	400
Pasture, acre	¾
Man labor, hours	15
Dairy heifers, per heifer	
Corn, bushels	5
Mill feed, pounds	50
Legume hay, pounds	1000
Pasture, acres	1.5
Man labor, hours	12
PRODUCTION, pounds	600
Fat hogs (10), per sow	
Corn, bushels	150
Tankage, pounds	100
Skimmilk, pounds	300
Pasture, acres	1.5
Miscellaneous cost	$0.40
Man labor, hours	80
PRODUCTION,[3] pounds	2000
Feeder pigs (10), per sow	
Corn, bushels	80
Tankage, pounds	20
Skimmilk, pounds	300
Pasture, acre	1.0
Miscellaneous costs	$0.20
Man labor, hours	40
PRODUCTION,[3] pounds	1000
Chickens, per hen[11] (Farm flocks)	
Corn, bushels	1
Mash, pounds	18
Chick feed, pounds	8
Skimmilk, pounds	35
Grit, pounds	2
Miscellaneous costs[12]	$0.01
Man labor, hours	1.8
PRODUCTION	
Cull hens, pounds	3
Eggs, dozen	7
Fryers, pounds	6.5

Feeders, per 100 pounds gain—(Cont'd)	
Legume hay, pounds	500
Pasture, acre	0.3
Miscellaneous costs	$0.06
Man labor, hours	3
PRODUCTION, pounds	100
Feeders, per 100 pounds gain (Purchased or weaned in fall and sold in spring.[8])	
Corn, bushels	8.9
Cottonseed meal, pounds	59
Legume hay, pounds	500
Miscellaneous costs	$0.10
Man labor, hours	2.5
PRODUCTION, pounds	100
Feeders, per head (Purchased in spring and sold in fall; pasture only,[9])	
Pasture, acres	2
Miscellaneous cost	$0.50
Man labor, hours	3
PRODUCTION, pounds	165
Beef heifers,[10] per head	
Corn, bushels	3
Legume hay, tons	1
Pasture, acres	2
Miscellaneous cost	.25
Man labor, hours	2
Sheep, per mature head	
Corn, bushels	1⅓
Legume hay, pounds	200
Pasture, acre	0.9
Miscellaneous costs	$0.20
Man labor, hours	6
PRODUCTION	
Lamb, pounds	73
Wool, pounds	5⅓
Workstock, per head	
Corn, bushels	37
Hay, tons	1.5
Pasture, acres	2
Miscellaneous cost	$1.00
Man labor, hours	45

1 Because of the variability in pastures these are inserted as a guide and for comparison between enterprises. 2 Assumes a 90 per cent calf crop and credits returns from a veal calf to the dairy cow. 3 One sow usually produces 10 pigs per year. 4 Plus costs for maintaining bull or for breeding fees. 5 In addition small quantities of butterfat will be produced on some farms. 6 Not allowing for breeding herd replacement but for a 90 per cent calf crop. 7 The usual weight at which these cattle are purchased is 425 pounds. Gain from start to finish is estimated at 375 pounds. 8 The usual purchase weight of the cattle handled by this method is 525 pounds. The net gain for these cattle is usually about 340 pounds. 9 The usual purchase weight for cattle in this group is 650 pounds. 10 For replacement. 11 The feed quantities shown here are for the mature birds with young chickens raised to 2½ pounds or more. Usually two young chickens are raised per hen. 12 If chicks are purchased the cost should be added.

TABLE 6—Average Prices Received by Farmers, 1936-1939, Pennyroyal Area, Kentucky

Crops	Price	Livestock	Price
Tobacco, per 100 pounds		Dairy	
Burley		Milk, per 100 pounds	$ 1.47
Level-land farms	$17.94	Butterfat, per pound	.25
Rolling-land farms	15.36	Veal calf, per 100 pounds	8.87

(Continued on page 203)

TABLE 6—(*Continued*)

Crops	Price
Tobacco, per 100 pounds—(Cont'd)	
Dark air-cured	
Level-land farms	7.76
Rolling-land farms	7.06
Dark fire-cured	
Level-land farms	9.60
Rolling-land farms	8.73
Grains, per bushel	
Corn	.71
Wheat	.80
Barley	.65
Oats	.60
Hay, per ton	
Red clover	11.30
Lespedeza	8.00
Grass	10.00
Alfalfa	12.10
Soybeans	10.50
Seeds, per 100 pounds	
Red clover	16.00
Lespedeza	3.75
Crimson clover	8.73
Redtop	10.00
Orchard grass	12.00

Livestock	Price
Dairy—(Cont'd)	
Yearling heifer, each	20.00
2-year-old heifer, each	40.00
Hogs, fat, per 100 pounds	7.92
Beef, per 100 pounds	
Feeders, winter fed	8.60
Feeders, pasture-and-grain fed	7.80
Fat calves	7.60
Cull cows	5.50
Sheep	
Lambs, per 100 pounds	9.40
Wool, per pound	.32
Poultry	
Eggs, per dozen	.185
Broilers, per pound	.18
Fryers, per pound	.12
Cull hens, per pound	.134
Workstock	
Yearling colt, each	68.00
2-year-old colt, each	125.00

TABLE 7—AVERAGE PRICES PAID BY FARMERS, 1936-1939, PENNYROYAL AREA, KENTUCKY

Item	Cost
Labor	
Year round, per month	$23.00
4 to 10 months, per day	1.00
100 days or less, per day	1.10
Fertilizer, per ton	
0-10-4	20.00
20% superphosphate	22.00
47% AAA phosphate	36.00
Plant bed	32.00
Nitrate of soda	45.00
Cyanamid	50.00
0-10-10	26.00
3-8-6	25.00
4-8-6	30.00
4-12-8	36.00
6-8-6	36.00
Potash	56.70
Limestone, per ton	1.50
Seeds	
Corn, hybrid, per bushel	5.00
open pollinated, per bushel	1.00
Wheat, per bushel	.80
Barley, per bushel	.80
Rye, per bushel	1.00
Oats, per bushel	.60
Soybeans, per bushel	1.50
Cowpeas, per bushel	2.00
Tobacco, dark, per ounce	.75
burley, per ounce	1.50
Alfalfa, per pound	.25
Red clover, per pound	.20
Sweet clover, per pound	.075
Alsike, per pound	.30
Lespedeza, per pound	.045
Crimson clover, per pound	.10
Hairy vetch, per pound	.10
Timothy, per pound	.06
Red top, per pound	.12
Orchard grass, per pound	.17

Item	Cost
Supplies	
Twine, per pound	$ .09
Baling wire, per bale	1.40
Tobacco cotton, per sq. yd.	.035
Lead arsenate, per pound	.12
Paris green, per pound	.40
Sawdust, per load	6.50
Kerosene, per gallon	.10
Gasoline, per gallon	.16
Oil, per quart	.16
Grease, per pound	.11
Feeds	
Corn, per bushel	.71
Mixed hay, per ton	12.50
Cottonseed meal, per 100 pounds	1.55
Tankage, per 100 pounds	3.00
Soybean meal, per 100 pounds	1.50
Dairy feed, per 100 pounds	1.65
Bran and shorts, per 100 pounds	1.50
Laying mash, per 100 pounds	2.75
Chick feed, per 100 pounds	3.00
Salt, per 100 pounds	.90
Oystershell, per 100 pounds	1.00
Machinery services	
Shredding corn, per shock	.12
Threshing	
Wheat, per bushel	.06
Barley, per bushel	.05
Oats, per bushel	.05
Rye, per bushel	.06
Lespedeza, per pound	.01
Baling hay, per ton	2.00
Steaming plant bed, per sq. yd.	.04

(Continued on page 204)

TABLE 7—(*Continued*)

Item	Cost	Item	Cost
Combining		Feeder calves	
Small grain, per acre	2.50	Purchased in fall and sold 10 months later, per 100 pounds	7.35
Lespedeza, for one-half of the seed	....	Purchased in the fall and sold in following spring, per 100 pounds	7.00
Red clover, per bushel	1.50		
Crimson clover, for one-half of the seed	....		
Red top, per pound	.03	Baby chicks, per hundred	8.00

SECTION III. METHOD FOR ANALYZING CHANGES

In Sections I and II are presented the crop and livestock data on which a budgetary analysis of a farming business in the Pennyroyal area must be based. In Section III a method of making the budgetary analysis is described.

Some of the costs on the farm, however, cannot be satisfactorily charged to specific crop or livestock enterprises because of the varying relationships to other enterprises. For example, machines and labor are used for nearly all crop enterprises, and buildings, fences, and labor are needed in connection with nearly all kinds of livestock. It is very difficult to charge the correct share of cost to each enterprise; consequently, it is better to treat them as "whole-farm" charges. Guides for calculating "whole-farm" costs are included in this section. The prices used in these guides are those of 1939, which were perhaps more nearly "normal" than those which have prevailed since. Knowledge of current farming trends and prices, however, is essential in using this or any other method in considering current economic conditions. The budget approach, carefully used, is the best means of deciding upon desirable changes in production.

FARM MACHINERY COSTS

Value of farm machinery varies according to type and size of farm. Crop farms usually have a greater investment in machinery than livestock farms, though the data in this study of Pennyroyal farms do not show these differences conclusively. Average values for machinery on tractor and nontractor farms are shown (Table 8).

TABLE 8—AVERAGE REPORTED VALUE OF MACHINERY ON TRACTOR AND HORSEPOWER FARMS, 1939, PENNYROYAL AREA

Size of farm[a]	Average acres	Values of machinery on tractor farms				Value of machinery on horse-power farms
		Tractor	Tractor equipment	Other machinery	Total, all machinery	
Small[b]	41	$450	$200	$200	$850	$ 83
Small to medium[b]	111	470	190	320	980	190
Medium to large	203	460	230	280	970	242
Large	369	640	325	1000	1965	665

[a] In fairly level areas the classifications of farms were *small*, under 70 acres; *small to medium*, 70-159.9 acres; *medium to large*, 160-269.9 acres; and *large*, 270 acres or more. On rolling land the classifications were *small*, under 50 acres; *small to medium*, 50-129.9 acres; *medium to large*, 130-229.9 acres; and *large*, 230 acres or more.

[b] Very few tractors and very little tractor equipment were found on farms in these size-groups. Usually tractors on these farms also were used for custom work on neighboring farms.

ESTIMATING TRACTOR USE, PER ACRE. – On farms having a tractor the hours of use must be estimated to obtain the operating cost. This can be done reliably by multiplying the acreages of crops on which use is intended, by the tractor hours usually necessary per acre. The kinds of tractor implements used will also affect the hours of use required to complete various operations with the tractor. Average tractor time for different farming operations has been computed as follows:[1]

	Hours per acre
Breaking (two 12-inch plows)	1.6
Breaking and disking (6-ft. tandem disk twice over the land)	2.6
Breaking, disking, harrowing, and cultivating (8-ft. harrow, once over; 2-row cultivator, 3 times over)	4.6
Disking	1.0
Disking and binding (7-ft. binder)	1.5
Disking and combining (5-ft. combine)	2.0
Drilling grain (10-hole drill)	0.7
Mowing (7-ft. mower)	0.4

For belt work and miscellaneous farm jobs, estimate according to the number of belt-type implements and the expected time each will be used, and the number of miscellanous jobs. On the Pennyroyal farms studied the tractor use on miscellaneous farm jobs amounted to 0.08 hours per tillable acre.

TRACTOR COSTS, PER DAY. – Tractor costs per day vary with size of implements, type of work, and the land. The average operating costs shown here are for 2-plow tractors doing field work (Table 9).

TABLE 9—AVERAGE CASH COST OF TRACTOR AT WORK, AT 1936-1939 PRICES

Cost item*	Quantity used per day	Price	Cost per day
Kerosene	18 gallons	$ .10	$1.80
Gasoline	½ gallon	.16	.08
Oil	2 quarts	.16	.32
Grease	½ pound	.11	.06
Total			$2.26

* Fixed cost items, such as depreciation, are given in Table 12.

REPAIR COSTS. – The annual cash repair cost on all machinery averages about 4.5 per cent of the value on farms with tractors and tractor equipment, and about 6 per cent on farms without tractors.

TRUCK COSTS[2]

Expenses for gasoline, lubricants, tires, batteries, and general repair average 1.8 cents per mile for ½-ton trucks and 2.7 cents for 1½-ton trucks. Depreciation costs are shown in Table 12. Licenses and bridge tolls are costs to be considered.

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[1] Ernest J. Nesius and Max M. Tharp. Farm labor requirements. Ky. Agr. Expt. Sta. Farm Econ. Misc. Mimeo. 126. Feb., 1943.

[2] G. B. Byers and Ernest J. Nesius, Farm power costs. Ky. Agr. Expt. Sta. Farm Econ. Misc. Mimeo. 113. June, 1942.

CAPITAL VALUES

Investment in real estate differs considerably according to topography and size of farm. The Pennyroyal farms with predominantly rolling land were valued considerably lower than those on fairly level land because of the lower production rates on the rolling land.

Investment in buildings increased roughly in proportion to size of farm in each land class (Table 10).

Values placed upon the different kinds of livestock were fairly well in keeping with the returns to be realized from them (Table 11).

TABLE 10—Reported Average Value of Real Estate, by Size of Farm and Land Class, 1939, Pennyroyal Area

Size and land class	Acres per farm, average	Fences per farm	Buildings per farm	Land, fence, and buildings per farm	Land, fence, and buildings per acre
Small farms					
Fairly level (under 70 acres)	63	$110	$2000	$4770	$76
Fairly rolling (under 50 acres)	30	50	870	1950	65
Small to medium-size farms					
Fairly level (70-159.9 acres)	116	250	2000	5945	51
Fairly rolling (50-129.9 acres)	109	225	1800	4090	38
Medium to large farms					
Fairly level (160-269.9 acres)	224	575	3250	13330	60
Fairly rolling (130-229.9 acres)	191	500	2000	7290	41
Large farms					
Fairly level (270 acres or more)	396	1050	4620	23230	59
Fairly rolling (230 acres or more)	356	910	5000	18170	51

TABLE 11—Reported Average Value of Livestock, per Head, 1939

Kind	Value	Kind	Value
Dairy cows	$ 45.00	Rams	$ 15.00
Dairy heifers	25.00	Sows	15.00
Bulls	80.00	Boars	15.00
Beef cows	70.00	Hens	.75
Beef feeders	40.00	Workstock	100.00
Ewes	7.50	Colts	80.00

DEPRECIATION RATES OR ANNUAL REPLACEMENT COSTS FOR MAJOR FIXED COST ITEMS

Depreciation or capital replacement is a significant cost on farms. This cost is fixed and it is important to accumulate a capital reserve to replace it (Table 12). Taxes and insurance are also relatively fixed (Table 13).

TABLE 12—Annual Depreciation Rates and Replacement Costs, Pennyroyal Farms, 1939

Item	Annual rate or replacement cost	Item	Annual rate or replacement cost
Buildings	3 per cent	Bulls	$5.00 per head
Fences	5 per cent	Ewes	1.35 per head
Machinery:		Rams	6.00 per head
Farms with tractors	9 per cent	Sows	1.00 per head
Farms without tractors	5 per cent	Boars	2.00 per head
Truck	11 per cent	Chickens	.10 per head
Dairy cows	$6.00 per head	Workstock	10.00 per head
Beef cows	2.00 per head		

TABLE 13—TAXES AND INSURANCE PAID PER FARM, PENNYROYAL AREA, 1939

Size group and land class	Average acres	Average taxes	Average insurance on selected farms[1]
Small farms			
Fairly level (under 70 acres)	63	$37	$32
Fairly rolling (under 50 acres)	30	21	21
Medium small farms			
Fairly level (70-159.9 acres)	116	50	42
Fairly rolling (50-129.9 acres)	109	38	24
Medium large farms			
Fairly level (160-269.9 acres)	224	103	64
Fairly rolling (130-229.9 acres)	191	82	42
Large farms			
Fairly level (270 acres or more)	396	221	75
Fairly rolling (230 acres or more)	356	156	79

1 Average for farms paying on insured property.

AUTOMOBILE COSTS

Automobiles are kept for both farm and family use, and the costs are chargeable to the farm in proportion to amount of use for farm business. Some operators of small farms did not own an automobile; those who did used it very little (Table 14).

TABLE 14—AVERAGE AUTOMOBILE EXPENSE PER YEAR CHARGEABLE TO THE FARM, PENNYROYAL AREA, 1939

Size of farm[a]	Fairly level	Fairly rolling
Small	$ 80	$ 25
Small to medium size	90	58
Medium to large	117	100
Large	150	100
All farms	97	63

a In fairly level areas the classifications of farms were *small*, under 70 acres; *small to medium*, 70-159.9 acres; *medium to large*, 160-269.9 acres; and *large*, 270 acres or more. On rolling land the classifications were *small*, under 50 acres; *small to medium*, 50-129.9 acres; *medium to large*, 130-229.9 acres; and *large*, 230 acres or more.

CASH REPAIR COSTS FOR BUILDINGS AND FENCES

The annual cash repair cost for buildings and fences averages about 3 per cent of the value.

TO CALCULATE LABOR COSTS

Calculating cash labor costs on a farm is difficult because of differences in individual accomplishment and systems of farming followed. A reasonable guide for calculating the cash cost can be obtained by estimating the total hours of productive labor necessary for the crops and livestock.[1] This can be done by multiplying the number of acres and of livestock by the number of hours shown in Tables 4 and 5, then converting to 10-hour days. Labor on crops and livestock for which tenants or croppers are responsible should not be included in these calculations. The difference between the number of days of labor necessary for the year and the number provided by the operator and family would presumably be hired. If the operator or hired

1 Ernest J. Nesius and Max M. Tharp. Farm labor requirements. Ky. Agr. Expt. Sta. Farm Econ. Misc. Mimeo. 126. February, 1943.

laborer works regularly and is in good health, it is reasonable to assume that he does about 200 days of productive work per year.

The following examples illustrate the method of calculating cash labor costs.

	Farm A		Farm B	
Total days needed for crops and livestock		250		640
Days furnished by operator	200		200	
Days furnished by operator's family	30	230	...	200
To be hired		20		440
Regularly employed labor	...		400	
Seasonal day labor	20	20	40	440

To estimate the cash cost of labor, use the following procedure:

For less than 100 days hired, use the seasonal day rate.
For 4 to 10 months hired, use the summer month rate.
For year-round hire, use the regular month rate.

The cost of labor performed by croppers can be determined by estimating the value of the cropper's share of the production, using market prices, and deducting the cash outlays made by the cropper for fertilizer and supplies.

FARM PRODUCTS USED IN THE HOME

Farm products consumed in the farm home amount to a significant part of the total farm income. The values shown in Table 15 were obtained by using prices at the farm. On the farms studied in this Pennyroyal area more farm products were consumed in the home on the larger farms than on the smaller, partly because of the greater supply and partly because of the need to feed more hired laborers (Table 15).

TABLE 15—Quantity and Value per Farm, on Farm Products Used in the Home, Pennyroyal Area, 1939

Item	Quantity	Value
Small farms[a]		
Pork, live weight	800 lb.	$ 63.36
Milk	4000 lb.	58.80
Poultry, live weight	100 lb.	17.00
Eggs	150 doz.	27.75
Total value	....	$166.91
Medium small farms[b]		
Pork, live weight	1100 lb.	$ 87.12
Milk	5500 lb.	80.85
Poultry, live weight	125 lb.	21.25
Eggs	160 doz.	29.60
Wheat	20 bu.	16.00
Total value	....	$234.82
Medium large farms[c]		
Pork, live weight	1500 lb.	$118.80
Milk	5800 lb.	85.26
Poultry, live weight	250 lb.	42.50
Eggs	160 doz.	29.60
Wheat	50 bu.	40.00
Total value	....	$316.16

(Continued on page 209)

TABLE 15—(*Continued*)

Item	Quantity	Value
Large farms[d]		
Pork, live weight	2550 lb.	$201.96
Milk	5800 lb.	85.26
Poultry, live weight	250 lb.	42.50
Eggs	170 doz.	31.45
Wheat	50 bu.	40.00
Total value	....	$401.17

[a] Under 70 acres on fairly level land, and under 50 acres on rolling land.
[b] 70-159.9 acres on fairly level land; 50-129.9 acres on rolling land.
[c] 160-269.9 acres on fairly level land; 130-229.9 acres on rolling land.
[d] 270 acres or more on fairly level land; 230 acres or more on rolling land.

This budget supplies the farm operator with a wide variety of information about the proposed plan of operation. He learns how much of the crop and livestock production will be consumed on the farm under normal conditions and how much will be available for sale. He determines how much feed he will have to purchase to supplement home grown supplies. He finds out just what he will need to purchase in the way of supplies and services for crop and livestock production. He knows how much labor he will have to hire. He can determine the prospective net income at any given level of prices for farm products and production goods and services.

In this particular case he finds that at the 1936 to 1939 price level the farm would yield a net cash income of $3,341 under the suggested organization plan. In addition to the cash costs listed, there is an annual depreciation of buildings, machinery, and livestock amounting to $522. Over a period of years this would have to be met out of the income of the farm or the capital structure could not be maintained. If this depreciation is deducted from the net cash income, $2,819 is left as a return for the use of capital and the labor and management of the farmer and his family. If the farmer assumes that he could earn four per cent on the capital ($27,484.50) invested in his farm business if used in some other way, the annual alternative use value of that capital is $1,114. Deducting that sum leaves $1,705 as the return to the family for labor and management. In addition to this cash return, they have the use of the farm house, and have also farm products to use in the home which have a market value of $401.

This particular budget is not presented because the plan of operation outlined is generally applicable to other farms. It is offered to illustrate the type of information needed, the process of analysis involved, and a systematic plan for budget construction. This budget may not be applicable outside the Pennyroyal area

FARM BUDGET FORM

Name *John Doe* Kind of farm *Large crop-general farm on level land*

Alternative Organization: Present ✓ Proposed No. 1 ______ No. 2 ______

LAND USE SUMMARY

Harvested crops *205.5* Acres Permanent pasture, tillable ______ Acres Total tillable land *359.4* Acres Other land *47.7* Acres

Rotation pasture *153.9* Acres Other tillable land ______ Acres Non-tillable pasture ______ Acres Acres operated *407.1* Acres

CROPS

Kind of crop	Acres	Yield per acre (Table 4)	Total production	Disposal of crops: Home use (Table 15)	Seed (Table 4)	Feed (Table 5)	Crops sold: Amount	Price (Table 6)	Value: Operator	Value: Share given	Labor needed (Table 4)
								$	$	$	
Corn	60.4	37 bu.	2234.8 bu.			2235 bu.					1026
Corn stover	(8)		8 T.			8 T.					
Corn (Cut) Cropper ½	8	37 bu.	296 bu.			148 bu.	148 bu.	71¢	—	105.08	
Wheat	51.1	18 bu.	920 bu.	50 bu.	64 bu.		806 bu.	80¢	644.80		460
Barley	31	24 bu.	744 bu.		62 bu.	352 bu.	330 bu.	65¢	214.50		279
Oats	9	31 bu.	279 bu.		13.5 bu.		265.5 bu.	60¢	159.30		72
Soybean hay	12.6	1.5 T.	18.9 T.			18.9 T.					214
Alfalfa hay	8	2.5 T.	20 T.			20 T.					160
Lespedeza seed	103	260 lbs.	26,780 lbs.		2060 lbs.		24,720 lbs.	3.75 cwt.	927.00		206
Burkytab Cropper ½	34	1060 lbs.	3,604 lbs.				3,604 lbs.	17.94 cwt.	323.28	323.28	
Garden	1										
Acres of crops	287.5										
Acres double cropped	82										
Acres in crops	205.5							TOTAL	$2268.88	$ 428.36	2417

LIVESTOCK

Kind of livestock	No.	Net production (Table 5): Kind	Amount	Disposal of products: Home use (Table 15)	Sales (Table 6): Amount	Value	Feeds fed (Tables 5 and 7): Home-grown feed: Corn	Hay	Other: Kind	Other: Amount	Pasture	Purchased feed: Kind	Amount	Cost	Miscellaneous cost (Tables 5 and 7): Item	Amount	Cost	Labor needed (Table 5)
		milk	6200 lbs.	5200 lbs.	18 lbs. B.F.	$ 4.50								$			$	
		veal	300 lbs.	—	300 lbs.	26.61			milk	1800 lbs.								
Milk cows	2						25 bu.	3 T.	barley	29 bu.	6	C.S.M.	80 lbs.	1.24	Vet		2.00	260
		cull hens	150 lbs.		150 lbs.	20.10						mash	900 lbs.	24.75				
		eggs	350 doz.	170 doz.	180 doz.	33.30						grit	100 lbs.	1.00				
Hens	50	fryers	325 lbs.	250 lbs.	75 lbs.	9.00	50 bu.		skim milk	1750 lbs.	run of farm	chick feed	400 lbs.	12.00	misc.		.50	90
		lambs	3650 lbs.		3650 lbs.	343.10												
Ewes	50	wool	275 lbs.		275 lbs.	88.00	40 bu.	5 T.	barley	41 bu.	30				misc.		10.00	300
									barley	117 bu.		Tankage	1000 lbs.	30.00	misc.		4.00	
Sows	10	fat hogs	20,000 lbs.	2,550 lbs.	17,450 lbs.	1382.04	1400 bu.		skim milk	3000 lbs.	15							800
Feeding cattle[a]	35	beef	13,125 lbs.		28,000 lbs.	2184.00	633 bu.	204 T.	barley	165 bu.	34	C.S.M.	3412 lbs.	52.89	misc. feeders	14875 lbs.	7.88 1094.80	393.75
									stover	8 T.								
Workstock	6						222 bu.	9 T.			12				misc.		6.00	270
TOTALS						$4090.65	2370 bu.	37.4 T.			97			$121.89			$1125.18	2113.75

[a] Purchased in the fall and sold one year later.

CROP EXPENSES

Crop	Acres	Seed Amount (Table 4)	Seed Cost (Table 7)	Fertilizer Analysis	Fertilizer Amount (Table 4)	Fertilizer Cost (Table 7)	Other Item (Table 4)	Other Amount (Table 4)	Other Cost (Table 7)
			$	Plant bed fertilizer	204 lbs.	$ 3.26	sterilization		$ 4.25
				fertilizer 20%	408 lbs.	4.49	lead	34 lbs.	4.08
							canvas	34 yds.	1.19
(cropper)							treatment		.34
Burley tob.	3.4	2 oz.	3.00	3-8-6	255 lbs.	3.19	market		21.46
							threshing		55.20
Wheat	51.1	64 bu.	farm	fertilizer	8942 lbs.	98.36	twine	102 lbs.	8.18
							threshing		37.20
Barley	31	62 bu.	farm	fertilizer	3875 lbs.	42.62	twine	70 lbs.	6.30
							threshing		13.95
Oats	9	13.5 bu.	farm	fertilizer	900 lbs.	9.90	twine	20¼ lbs.	1.82
(cropper) Corn	8.	1 bu.	5.00						
Corn	60.4	7.5 bu.	37.50				-		
Soybean hay	12.6	12.6 bu.	18.90						
Alfalfa hay	8.	2 bu.	30.00	fertilizer	2,000 lbs.	36.00	limestone	16 T.	24.00
Lespedeza seed	103	2060 lbs.	farm				harvesting		267.80
Tillable acres	359.4			phosphate	3953 lbs.	71.15	limestone	38½ T.	57.75
TOTALS		xxx	$ 94.40	xxx	xxx	$ 268.97	xxx	xxx	$ 503.52
Amount paid by cropper			$ 2.50	xxx	xxx	$ 5.47	xxx	xxx	$ 4.93

CAPITAL VALUES

Item		Value (Tables 8, 10 & 11)
Real estate		$ 23,230
Buildings	$ 4620	xxx
Fences	$ 1050	xxx
All machinery		$ 1,965
Tractor	$ 640	xxx
Tractor machinery	$ 325	xxx
Other machinery	$ 1000	xxx
Truck		$ —
Dairy cattle		90
Beef cattle		1400
Sheep		375
Hogs		150
Poultry		37.50
Workstock		600
TOTAL		$ 27,847.50

DEPRECIATION

Item	Amount (Table 12)
Buildings	$ 138.60
Fence	52.50
Machinery	176.85
Truck	—
Dairy cows	12.00
Beef cows	—
Bulls	—
Ewes	67.50
Rams	—
Sows	10.00
Boars	—
Chickens	5.00
Workstock	60.00
TOTAL	$ 522.45

FINANCIAL SUMMARY

Cash Income

Crop sales (operator & share given)	$ 2697.24	
Livestock sales	4090.65	
AAA payments	225.00	
Total cash income		$ 7012.89

Expenses

Variable expenses:			
Crops			
Seed		$ 94.40	
Fertilizer		268.97	
Other		503.52	
Livestock			
Purchased feed		121.88	
Other		1125.13	
Hired labor (Page 36 & Table 7)		334.00	
Value cropper's share	(428.36)	xxx	
Expenses paid by cropper	(12.90)	xxx	
Cost of cropper labor (Value of cropper's share minus expenses paid by cropper)		415.46	
Automobile costs (Table 14)		150.00	
Truck costs (Page 33)		—	
Tractor costs (Page 33)		103.57	
Machinery repairs (Page 33)		88.42	
Building repairs (Page 35)		138.60	
Fence repairs (Page 35)		31.50	
Interest on short-term loans			
Total variable expenses			$ 3375.50
Return over variable expenses			3637.39
Fixed expenses:			
Taxes (Table 13)		221.00	
Insurance (Table 13)		75.00	
Interest on mortgage		—	
Cash rent		—	$ 296.00
Total fixed expenses			3671.50
Total cash expenses			3341.39
Net cash income		522.45	
Depreciation		1113.90	
Interest on invested equity, 4%			$ 1636.35
Total			
Return to family for labor and management			$ 1705.04
Value, home-used products (Table 15)			401.17
Net earnings to family for labor and management			$ 2106.21

of western Kentucky and it may not even fit many farms there. The general method, however, can be used for any type of farm in any state, but it must be implemented with basic information that fits the farm to which it is to be applied.

It should be obvious, of course, that the mere construction of a farm budget does not in itself ensure a profitable farm business. The budgeting method merely offers a systematic and relatively simple method of computing the probable net income that might normally be expected to result from the adoption of a given plan of farm organization. Only by comparing various possible plans can one determine the one that promises the greatest returns. The process of developing and using comparative budgets will be discussed in the next chapter under the heading of the substitution method.

CHAPTER XVII

WHICH PLAN PROMISES THE BEST RETURN?

In most areas there is a considerable variety of crops and classes of livestock from which one may build a farm organization. There are also various methods of production involving different kinds and amounts of labor, power, and equipment, from which to make a selection. Some choices of crops or livestock may contribute much more to the net earnings than others. The advantage varies with the price level of farm products and of production goods and services. Farming is a highly complicated business and any adjustment in one crop or one class of livestock is likely to affect the production of some other crop or livestock product. The "method of substitution" is an adaptation of the budgeting method to the particular problem of choosing the most profitable farm organization or plan of operation among the various choices that confront the farmer. It is the simplest guide to the choice of the best method of production, that takes into consideration the interrelation between different parts of the farm business.

The essential difference between the method of complete budgeting as outlined in the previous chapter and the method of substitution lies in the final net income figure. Under the complete budgeting method the final net income figure is computed by deducting from the gross income all items of cost, whereas under the substitution method only the differences in variable costs between two alternative plans are considered. The net income figure computed through the complete budget analysis indicates the absolute return or earnings for each organization plan budgeted. The substitution method indicates only the difference in return among two or more plans that are being tested. Considerable time may be saved by the use of the substitution method, and for comparative purposes the results are equally useful.

The same general types of information are needed for the substitution method as for the complete budget. It is, however, possible to omit such items as building and machinery costs and depreciation, taxes, insurance, interest charges, and other items that are constant factors in the several plans under consideration. Where these items vary between the different plans it is necessary

only to compute the increases or decreases in these items rather than to compute the complete item for each plan. The substitution method may be used for many of the same purposes as the complete budget, such as (1) comparing alternative plans for a new farm business, (2) comparing alternative plans for a going farm business, (3) comparing the returns from alternative farm enterprises, and (4) comparing alternative methods of production. The results will not indicate the complete earnings or returns that may be expected from the adoption of any one of the plans. It will, however, give as accurate a picture of the relative returns as will the complete budget, and at a considerable saving of time.

EXAMPLES OF BUDGETING ANALYSIS

Setting Up a New Farm Business. An illustration of the use of the substitution method in setting up and planning a new farm business is shown in Chapter VIII. Here the prospective purchaser tests the earning power of the farm under three different types of organization. Obviously there are other alternatives to be considered in addition to those listed but these are sufficient to illustrate the method. An important feature of this method of analysis is the relatively high degree of accuracy and significance of the comparison between different organizations, even though only those factors are included in the computation that vary between the organizations being compared. A large number of factors such as taxes, insurance, building and machinery costs, have been omitted from this calculation since they are constant factors in each plan. This saves a considerable amount of time over what would be required for a full, itemized distribution of all cost elements such as would be involved in a complete budget. A complete budget would indicate the exact amount of money the operator might expect from each plan under the price and production assumptions upon which it is based. Insofar as the farm manager is primarily interested in the relative returns from the different plans of organization he can determine them most easily by the "short-cut" substitution method shown.

Comparing Alternative Plans for a Going Farm Business. The same general method is used in comparing alternative plans for a going farm business as was discussed in the previous section for setting up a new farm business. The results are likely to be more precise, since more information about the going business is

available. Even though the farmer has kept no records, he can supply much of the information needed from memory. He knows more about the quality of both the land and the livestock than he would know about setting up a new business and hence is able more accurately to estimate crop yields and rates of livestock production. He knows from past experience what crops have done well on different parts of the farm and what the important limitations may be.

The principal difference between the process of substitution analysis for the going farm business and that for a new farm is the use of a present normal set-up as the starting point. The farm manager must have some base from which to calculate the advantage or disadvantage of the alternative plans he is considering. Unfortunately, no one year is normal in all respects; crop yields, livestock production, prices for products sold or purchased, insect and disease damage, and other factors that affect farm profits fluctuate. For this reason it is seldom feasible to use the results of any one year's operations as a base for comparisons. The common practice is to set up a "present normal organization" for this purpose.

The first step is to list the farmer's resources in land, capital, livestock, machinery, labor, and other factors of production. Then make a statement of normal crop yields, livestock production, rates of feeding, and other items of cost or input as was illustrated for the complete budget in the previous chapter. A schedule of prices should be prepared of goods and services bought and sold based on the best available estimates of future conditions. This price schedule, as well as the schedule of yields and input factors, should be used both for the alternative plans and for the "present normal organization" unless some organizational difference in the plans may result in a change in the quality of product, efficiency, or rate of production.

In preparing the "present normal organization" statement, start with the cropping system as illustrated in Table VII, Chapter VIII or Tables XVII and XVIII, Chapter XIII. Then prepare a statement of feed requirements for the present normal numbers and kinds of livestock (see Table XXII, Chapter XIV). By comparing the crop production with the amount needed for livestock feeding and seed, the amount of crops available for sale and the amount of feed that must be purchased can be determined. Then list the items of crops, livestock, and livestock products available for sale and compute their value at the assumed

market price schedule mentioned above (see Table X, Chapter VIII). The gross income from sales is obtained by totaling these values. In computing the expense to be deducted from this it is necessary to include only those expenses which vary directly with the organization, i.e., that vary with the acres of crops, the number and kind of livestock, and the farming practices assumed. The net income figure obtained by deducting the variable expenses from the gross income from sales forms a basis for comparing the possible net incomes of the different plans, and the advantages and disadvantages of each.

The gross income and the variable expense for each of the plans may be computed in the same way as for the present normal plan. It is not necessary to include in the variable expenses the entire cost of items such as labor, machinery, buildings, interest taxes, insurance, as was done in the complete budget, even though they may differ from the corresponding cost for the "present normal." Much time can be saved if only the increases or decreases are included and not the total amounts, since totals would also have to be computed for the "present normal" if valid comparisons were to be made. By comparing the return above variable costs for each of the plans with that of the "present normal," the advantage or disadvantage of each can be determined in monetary terms. (It must be recognized, of course, that considerations other than money income may be deciding factors in the farmer's choice.) The accuracy of this type of comparison is dependent on the accuracy of the data on which it is based. Farming is highly dynamic and the future, particularly future prices, can not be more than approximated. However, a careful balancing of possible choices is the simplest and surest way to improve the farm organization and avoid making expensive mistakes that might occur if new plans were tried out in practice before being tested on paper.

Once the basic data is assembled and the "present normal organization" set up, comparatively little time is needed to prepare substitution budgets. It is, therefore, desirable to prepare a number of plans and to compare them under different assumptions as to future price relationships. In Table XXVI a comparison is shown of three different organizations for an Arkansas farm under both normal and wartime prices. The same plan has the advantage under both price levels. A comparison is shown in Table XXVII for a Minnesota farm for three different organizations and for ten different sets of price levels and relationships.

With all price combinations Plan B has the advantage over the "present normal," and in all but one case over the other two plans. With such a clear advantage the farmer would feel much safer in electing that plan. It requires relatively little time to compute the alternative plans under different price assumptions, and it may be time well spent.

COMPARISON OF ALTERNATIVE LINES OF PRODUCTION. Comparing alternative lines of production by the substitution method is a simple adaptation of the principles already discussed. It is necessary to consider only the outlays or payments that vary between the two enterprises and the difference in the value of the returns. In the case of crops such as oats and barley which compete directly for land, labor, power, and machinery and for which the variable

TABLE XXVI—CASH RETURNS ABOVE VARIABLE EXPENSES FROM DIFFERENT ORGANIZATION PLANS FOR A GIVEN FARM UNDER NORMAL EXPECTED AND WARTIME PRICES [1]

Price Level	Organization			
	Normal Present	Emphasis on Crops	Emphasis on Livestock	Additional Land
Expected Normal	$196	$235	$356	$534
Wartime	400	537	718	1,062

[1] From Bulletin 435, Arkansas Agricultural Experiment Station, pp. 35, 37, 40, 43, and 69.

costs per acre are approximately the same, choice depends largely on the cash or feed value produced per acre.[1] If there is a material difference in direct cash costs between two different crops or a marked difference in the seasonal distribution of labor, it is necessary to make a study of the differences in costs as well as in returns. As in the case of other substitutions, it is important to remember that changes in the total hours of labor resulting from a shift from one enterprise to another need not enter into the computation unless more hired help is required for the alternative enterprise or the farmer is enabled to operate with less outlay for labor.

COMPARING ALTERNATIVE METHODS OF PRODUCTION. The substitution method may be used to study the advantage of alternate methods of production such as different kinds and combinations of power and machinery. The same analysis may be used to determine the amount that the farmer may safely invest in a given building or item of equipment. This method as applied to the

[1] H. C. Taylor, "The Objectives in Agricultural Cost Accounting," *Journal of Farm Economics*, Vol. V, No. 2, pp. 70-71.

TABLE XXVII—RETURNS FROM ACTUAL AND SUGGESTED REORGANIZATION PLANS WITH DIFFERING PRICE RELATIONSHIPS [1]

Item	Probable cash returns above cash expenses which vary directly with changes in organization when prices are as follows:									
Butterfat, per lb.	$0.30	$0.20	$0.20	$0.20	$0.30	$0.30	$0.30	$0.40	$0.40	$0.40
Potatoes, per bu.	.40	.20	.40	.60	.20	.40	.60	.20	.40	.60
Rutabagas, per ton	6.00	4.00	6.00	9.00	4.00	6.00	9.00	4.00	6.00	9.00
Price of purchased feeds (in percentage of assumed prices)	100	100	100	150	100	150	150	100	100	150
Present normal plan	$974	$695	$715	$675	$954	$910	$934	$1,113	$1,134	$1,219
Reorganization Plan A—probable returns	1,237	838	978	1,085	1,098	1,173	1,344	1,357	1,497	1,604
per cent of present plan	127	121	137	161	115	129	144	122	132	132
Reorganization Plan B—probable returns	1,369	903	1,110	1,290	1,162	1,304	1,549	1,422	1,629	1,809
per cent of present plan	141	130	155	191	122	143	166	128	144	148
Reorganization Plan C—probable returns	1,125	768	779	682	1,114	1,017	1,028	1,460	1,471	1,028
per cent of present plan	115	111	109	101	117	112	110	131	130	84

1 From Bulletin 295, Minnesota Agricultural Experiment Station, p. 100.

farm mentioned in Chapter XIII may be used to determine the effect of substituting tractor power for horse power.

The operator of this farm has kept approximately six work horses in recent years. He has raised a colt every two or three years for replacement. Occasionally, after unusual death losses, he has purchased one or two horses. A two-plow general-purpose tractor equipped with rubber tires and two horses should provide ample power for the farm. A plow and corn cultivator will have to be purchased to fit the tractor. Other tractor equipment would be desirable, but these purchases can be delayed until funds are available. Although not as efficient as tractor equipment, horses can be used temporarily.

Detailed records kept by this farmer during past years make it possible to prepare an accurate analysis of the power needs of this farm. Although such records are not generally available, most farmers can make estimates that will serve the purpose. Information which will be helpful for the analysis can be obtained from books, experiment station bulletins, and other pub-

TABLE XXVIII—Annual Hours of Use of Horses and Tractor and Hours of Man-Labor to Drive Horses and Tractor at Present and After Purchase of Tractor [1]

Task	Acres Covered*	Hours of Use at Present			Hours of Use After Purchase of Tractor		
		Man	Horse	Tractor	Man	Horse	Tractor
Care of livestock	....	65	130	....	65	130	....
General farm maintenance	....	112	224	....	88	176	20
Field work:							
Plowing	96	160	723	11†	115	....	115
Springtooth harrowing	52	25	90	....	18	....	18
Disking	57	30	118	....	19	....	19
Spiketooth harrowing	383	115	339	....	46	....	46
Planting corn	30	22	44	....	22	44	....
Cultivating corn	107	113	226	....	60	40	40
Cutting corn	30	43	119	....	60	....	30
Filling silo	13	75	150	18†	75	150	18
Shredding corn	17	141	282	30†	141	282	30
Seeding grain	64	40	154	....	19	....	19
Cutting grain	64	64	180	....	76	....	38
Threshing	64	210	248	16†	210	248	16
Cutting hay	40	46	92	....	46	92	....
Raking hay	54	29	58	....	29	58	....
Hauling hay	40	169	102	....	140	30	20
Hauling manure	299 loads	....	390	....	....	50	40
Total	....	1,459	3,669	75†	1,229	1,300	469

[1] Southeast Minnesota Dairy Farm.
* Acres in the field multiplied by the number of times field is covered.
† Hired.

lications that are available. The kinds and amount of work to be done and the time that will be required are presented in Table XXVIII. The hours of work under the present set-up with horses supplying the principal power are contrasted with those needed if a tractor were to be used. The principal operations for which the horses will be used are planting corn, some cultivation of corn, haying, threshing, silo-filling and corn-shredding. This horse work is so distributed throughout the year that not more than one team would be needed at any time. Since most of the work done would be light, the amount of grain per horse could be reduced materially.

If the number of work horses is reduced to two, it will probably be more desirable to buy replacements than to raise colts. There will be a saving of 550 bushels of oats or the equivalent in other grain, and 16 tons of hay. This would be ample to feed three cows and the necessary replacements and still leave approximately 400 bushels of oats for sale. On the other hand the 469 hours of tractor work would require about 700 gallons of tractor fuel and 15 gallons of oil. Approximately 230 hours man-labor would be saved in the operations for which the tractor replaced horses. The three additional cows and the heifers raised to replace them would require more labor than would be saved by the reduction in number of horses. The net result would be a slight reduction in hours of man-labor, but there would be no saving since more help than can be fully utilized is already available.

A summary of the items of income and expense that would be changed by a shift from horse to tractor power is shown in Table XXIX. Income would be increased by the product of the additional cows and the sale of oats no longer needed for horse feed. Expense would be decreased by the elimination of horse costs and tractor hire. Additional cash outlay would be needed for fuel, lubricants, and repairs for the tractor and tractor machinery, and some of the purchase price of the latter would have to be charged off as depreciation each year. Some allowance for horse replacements is made. The increases in outlay exceeded the decreases but the increase in income is large enough to make the shift to tractor power a profitable one.

In addition to the changes in income and expense that have been listed, there will be other factors to consider that are difficult to evaluate. With the tractor it may be possible to do the work more promptly and thoroughly than with horses, particularly when work days must be long and when the weather is very

hot. Since there is more labor available on this farm than is fully utilized, it is quite possible that the income of the farm might be further increased by doing custom work on neighboring farms. But the cash outlay will be larger. This may be a handicap in periods of depression when the prices of products sold usually decrease more than those of products purchased. An additional investment will be needed for the tractor and for machinery. The trading in of surplus horses and old machinery may not cover the full purchase price. A small amount of money may have to be borrowed in order to make the purchase.

TABLE XXIX—EXPECTED CHANGES IN INCOME, EXPENSES, AND EARNINGS RESULTING FROM THE INTRODUCTION OF THE TRACTOR

Item	Price	Quantity	Value
Increase in income:			
Value produced by cows	$92.00 per cow	3	$276.00
Veal calf	12.00 per calf	2	24.00
Oats	.35 per bu.	400	140.00
Total increase in income			$440.00
Expenses decreased by:			
Horse breeding fees	$25.00 per service	1 every 2 years	$12.50
Other cash expense for horses	4.00 per horse	5 horses	20.00
Hire of tractor	1.10 per hour	75 hours	83.00
Total decrease in expenses			$115.50
Expenses increased by:			
Replacement of horses	$100.00 per horse	1 every 6 years	$ 16.67
Cash cost of cows	2.00 per cow	3 cows	6.00
Tractor fuel	.09 per gal.	700 gal.	63.00
Oil	.60 per gal.	15 gal.	9.00
Grease			4.00
Depreciation and repairs on tractor and extra machinery			95.00
Total increase in expenses			$193.67
Net increase in expenses			$ 78.17
Increase in earnings from the farm			$361.83

All things considered, this shift from horse power to tractor power appears desirable and profitable. It gives this farmer a definite basis for a decision. It does not necessarily follow that all farmers would profit by a change of this kind. Each farmer must make such a calculation as this in order to answer the question for his situation. This same type of analysis may be used for determining the profitableness of other shifts in equipment, power, and methods of production.

ADAPTATION AND LIMITATIONS OF THE SUBSTITUTION METHOD

The substitution method is adapted to the solution of a wide variety of farm organization problems. It is one of the most useful tools of the farm manager. Certain limitations, however, must be recognized. Like the budgeting method it is no better than the basic information upon which it rests. Farm account records, supplemented with a careful appraisal of their application to future conditions, provide the most satisfactory basis for a budgeting analysis. Where records for the farm in question are not available, information from other sources must be adapted. Techniques in farming are constantly being improved, and estimates of future prices are subject to a considerable margin of error. For this reason substitution budgeting must be looked upon as a continuing process of analysis rather than a final solution. The farm organization must be studied currently if it is to be kept in balance and in adjustment to changing conditions.

It must also be recognized that an organization satisfactory for one farm or one farmer may not be as well adapted to any other farm or even to the same farm with a different operator. No two farms are likely to be similar in all respects, and no two farmers will have an identical set of resources and capabilities. Because of the relative ease with which the substitution analysis can be applied to a specific case, it is usually more satisfactory to study each case separately than to assume that a satisfactory solution of the organization problems for one farm would apply equally well to other farms of the same size and general type.

✓ CHAPTER XVIII

PRINCIPLES OF FARM OPERATION

It is now our purpose to give careful consideration to the principles and practices involved in successfully operating a farm unit after the preliminary organization plans have been completed. That a clear understanding may be reached of the duties and functions of the farmer in his capacity as both *organizer* and *operator* attention will first be given to comparing the functions of organization with the functions of operation and management.

THE FUNCTIONS OF ORGANIZATION

As the organizer of a farm business, the farmer is concerned chiefly with making plans and in providing correct proportions between the different parts of the unit he is organizing. First of all, he must have or acquire sufficient funds or capital goods to provide the land, buildings, equipment, and labor necessary. He decides where he will farm, the type of farm he will operate, and the equipment he will need. He must decide how much land it will be wise to include in the farm and the kind and number of buildings that will be needed. The equipment and livestock, if any is to be kept, must be selected, and the proportions of each determined. Plans must be made for the division of the farm into fields of suitable number and size, the crops that will be raised, and the rotations to be practiced, if any. In making these plans one must keep in mind the uses to be made of each crop or product and the form in which it will be used or marketed.

It will not be possible to make plans that can be followed without revision from time to time as experience and changing conditions show the need for reorganization. (The more complete and well considered the organization plans are, however, the less will be the need for expensive changes in organization. It is wise to draw several alternative plans of organization for a farm before adopting one as final.) Estimates of possible production and income and of probable labor requirements and expense in operating will be most helpful in reaching a right decision in many cases.

To organize means to put together in an orderly way all the

parts of the whole, to establish harmony between the parts, to plan for systematic production, or output—to bring into balance all the parts of the whole unit. Applied to a farm unit, organization means to bring into correct balance the elements of capital, land, labor, and management involved in the enterprise.

THE ELEMENTS OF FARM OPERATION

A machine in the finished form is the result of careful planning, assembly, and organization. It is useless, however, until put into action or operation. The operator puts life into the machine by throwing a switch, opening a valve, or by applying some other kind of power. After starting the machine, the operator must control the speed, the direction, and the load to be carried or the work to be done. If it gets out of control, damage to the machine or other property may result.

A farm, like a machine, should be the result of thoughtful planning, carefully built into a systematic well-organized unit ready to operate. Like the machine, a farm is put into action by the operator. Instead of throwing a switch or opening a valve, however, the operator starts the farm into action by preparing the land, sowing the seed, feeding and caring for animals, and giving attention to the many ever-recurring, overlapping tasks that crowd into each succeeding day. When once set in operation, the operator must continually direct the activities of the workers, and make decisions as to the work that shall first be done and the methods to be employed. On the skill of the operator depends the success of the enterprise and the personal or financial reward. Unless operations are wisely guided and controlled, damage to land, equipment, livestock, or the financial investment will result.

Responsibilities of the Farm Operator. The responsibilities of the farm operator are many and varied. It is his duty to handle the land to the best possible advantage, not only that large crops may be raised at the present, but that its productive power may be preserved for the years ahead. The operator decides how much labor to use and the enterprises on which it will be used. Livestock is kept for the purpose of increasing the income from farming. There are several kinds of livestock on most farms. The operator has the responsibility of deciding annually or oftener which kinds are likely to make best use of the available feed commodities and return the largest income to the farm business. Decisions are required yearly on the emphasis to put on the respective crops to be grown and whether to raise or buy certain

feeds required by the livestock. Which fields will be benefited most by an application of barnyard manure or other fertilizers? Shall pasturage be supplemented by grain fed to dairy cows or to cattle that are being fattened? Endless and ever-recurring are the problems of this nature that arise in the operation of a farm and for which the operator must find a solution.

Besides these production activities, there are maintenance problems to watch and provide for as well as the financial and business decisions that must be made from time to time and, in some types of farming, almost daily. The market gardener who sells on the open market or the livestock producer must watch market demands and prices closely or sell at a disadvantage. The buying also is done by the operator. It is important to buy wisely and only so much as can be paid for without limiting needful activities in other ways. In fact, successful operation may be quite as dependent upon wise buying and selling as upon large production.

AGRICULTURE A DYNAMIC INDUSTRY. Agriculture is a dynamic industry. Change is the rule rather than the exception. Few farm operations are performed in the same way or with the same kind of equipment used even twenty-five years ago. Some changes come slowly and almost imperceptibly. Others come with great rapidity, forcing new methods of operation that may render obsolete much of the old equipment. The development of the combine for harvesting crops gives an example of rapid change in methods of operation that affect both the financial investment and the use of labor. The development of strains of hybrid corn by plant breeders has greatly changed corn-growing methods and increased the yield per acre. A smaller acreage, therefore, may yield the production required, releasing other acres for some other desired crop or commodity.

No matter how well a farm may be organized, changes will inevitably be required from year to year. The operator must be alert, informed, and foresighted, in order to anticipate coming changes and modify his operations to meet them. American farmers have produced in the past large quantities of wheat, much of it for export to other countries not so favorably situated for wheat production. A few years ago because of nationalistic tendencies, unfavorable trade relations, lack of buying power, and war, buying of wheat by other nations was limited and farmers were forced to grow less wheat or sell what they did grow at a loss. At present wheat is again in strong demand for relief and rehabili-

tation and production is encouraged. Reduction of the cotton acreage in the South is leading to the growth of more corn, grass, and livestock than in the past. The farmers of the Corn Belt and of the dairy region, who have supplied meat and dairy products in large quantity to the people of the South are thus meeting greater competition in the sale of the products on the southern markets. Other examples of change might be given, but these are enough to show that the operator of a farm must be constantly alert to conditions, not only on his own farm, but in the great agricultural areas of the world.

FUNDAMENTALS OF GOOD OPERATION

The farm operator is much concerned with plant and animal life. The plants form the source of subsistence for the animals. Out of one, or both, comes not only food for subsistence of the farmer and his family, but the cash income for living expense, the payment of debts, and the purchase of the desired necessities and luxuries that the family enjoy. The basis for success in agricultural production lies in a wide knowledge of the laws of nature and particularly of those dealing with plant and animal life. It is well known among farmers that some have the knack of always having good yields and good quality crops. Other farmers are noted for high production records from their cows or for raising large litters of high-quality pigs. Others may excel in producing some other product that commands a premium.

These facts are not the result of chance. They arise rather from knowing the life habits of the plants and animals, and in the varying degrees of skill with which the essential elements for growth and well-doing are supplied. The production of plants and animals is essentially a biological process. One having a thorough knowledge of the natural laws governing the processes of plant and animal breeding and of the elements of plant and animal nutrition has a decided advantage in the production of crops and animals. That knowledge will be reflected in better crops and animals only if applied in the everyday activities of the operator responsible for the enterprise. The *will to do* what *should be done* is quite as important to the success of the farm operator as the knowledge of what should be done. Knowledge can not benefit anyone unless it is used. The operator determines whether or not knowledge shall be used.

Knowledge of Economic Laws Important. In these days of commercialized farming, where the farmer sells much that he

produces and buys from others many of the things used by his family, knowledge of the laws of economics is helpful to the farm operator. The law of supply and demand, when not disturbed by interference usually influences and determines prices. Large production is usually offset by lowered prices. Large numbers of meat animals will, likewise, eventually result in declining price levels. Because of the working of this law, long and short-time swings in price levels for most commodities may be observed. Fortunately, not all swings in price levels occur at the same time or within the same year. By studying market reports and the frequently published government "outlook reports" it is possible to anticipate shortages of certain commodities and prepare to take advantage of favorable prices. Likewise, it is often possible to avoid producing crops or products of which a large surplus is in store and which is almost certain to sell at a low price. By correct timing in the production and preparation of products for market one can often obtain a short-time advantage in market price which means the difference between loss or profit. The shrewd operator offers his goods for sale when a price advantage can be obtained.

FARMING NOT AN EXACT SCIENCE. Farming can never be reduced to an exact science or to routine procedure because of the many variables involved. These variables create many problems for the operator. A few may be mentioned.

Much of the farm labor is performed by the operator and his family. The daily tasks must be assigned to those best able to carry the load. Few of the family beside the operator can give full-time service. At some tasks a half-grown boy can do a man's work. At others he may be of little value. In chore work children can be used to some advantage where mature judgment is not required or where it can be directed by a mature supervisor. Some operators are much more successful than others in using child labor. The same may be said in regard to hired labor. In fact, hired labor may vary quite as much as children in skill and ability. To get full service from the labor available to the individual farm is one of the important tasks of the operator.

VARIATIONS IN POWER. Power may be supplied by horses, by internal combustion engines, or by electric service. On many farms a combination of these power services may be wise. In most cases the engine power should be portable and probably in the form of a suitable-sized tractor for field duty. Not all horses are equally powerful. The number kept and the number used on

an implement will be dependent upon their size and power. How many and when are matters of judgment for the operator to exercise. The efficiency of horses is often determined by the feed and care they get, and by the manner in which they are handled when at work. The attention given them is controlled by the operator. Tractors are more nearly standardized than horses; yet, there are differences in power, adaptability, and ease of operation, even though given the same power rating. Like horses, their efficiency is determined by the care given them and the skill with which they are operated. Here, again, the operator is responsible.

WEATHER VARIABLE. The weather is of considerable concern to the farm operator. Not that he can do anything to change it, but because it does much to affect his operations. His first thought in the morning and his last at night is likely to be of the weather and changes in plans that he may have to make on account of it. It affects not only the growth of his crops but of his animals. And it changes, too, the routine of his daily work and the efficiency with which many of the tasks can be performed. Ability to foretell or judge the weather and to prepare alternate use for labor which must be supported, rain or shine, is a distinct asset to a farm operator.

DECISIONS IMPORTANT. Making correct decisions is the most important duty of a farm operator. Often the decisions must be quickly made. They can be wisely made only if the operator has anticipated the need for them and has at his leisure or from previous experience evolved an alternative course of action. A change in the weather at midday may necessitate changing the orders given in the morning. An emergency may arise at any time that will call for treatment entirely opposite of what had previously been thought best. Illness of a member of a crew or an unexpected absence may involve reassigning tasks to all the workers in order to avoid neglect of an important project.

FUNDAMENTALS SUMMARIZED

The fundamentals of good operation and management may be summarized as follows:

1. Constant alertness is a first requisite. To recognize an opportunity to save labor, to improve a product, to reduce production cost, or to gain a market advantage will add to the net return from farming.

2. Foresight is indispensable to successful operation. To see the possibility or threat of trouble and to avert it before it starts

or has done damage is the mark of a good operator. It is equally helpful to see opportunities ahead for gain or more successful operation. Plans adjusted to meet an opportunity may also increase returns from operating.

3. "Knowledge is power," is one of the axioms of long ago. Its truth is nowhere more in evidence than in farm operation. To know the nature and growth habits of the wide range of plants and animals coming under the operator's management is no small responsibility. Upon that knowledge depends the success of many ventures in production. Knowledge of human relationships and behavior and of business transactions must supplement knowledge of crops and animals to complete the equipment of the operator.

4. Experience is the handmaid of knowledge. It is gained by first-hand contact with the everyday affairs of the farm. The boy who is fortunate enough to have been reared on a farm will gain experience by degrees in a way that will serve him well. The boy who has not lived on a farm will be wise to work on a farm under the direction of someone else before trying to operate on his own account. Experience gained without guidance is likely to prove a dear teacher.

5. Good judgment is the capstone of any business enterprise. Some persons are born with it, others acquire it by study, knowledge gained from experience, and by correcting former mistakes of judgment. No matter how gained, it is essential to the greatest possible success. The alert, foresighted, well-informed, experienced operator, who is blessed with good judgment and exercises his talents is well on the way to being a successful farm operator.

THE OBJECTIVE IN FARM OPERATION

Few farmers really define the objective of their farming operations. Most of them, if asked, would probably say that it is to make a living for themselves and their families. In general, that may be the correct answer, but a somewhat more accurate and specific definition of the objective can be stated. The real objective of a good farm operator is *to get the maximum returns in satisfactions and net profits* from a *minimum expenditure of resources and human effort.* That objective gained puts the operator and his family in a position to live comfortably and to enjoy a good standard of living. It can not be gained, however, without meeting certain requirements which vitally affect both the expenditure of resources and the returns gained from the expenditure.

KNOW THE DETAILS. (The first requirement is an *accurate knowledge* of the effect of everyday changes and actions that make for expense or income.) This knowledge may be gained from the records kept of cash receipts and expense, from a comparison of inventory gains and losses, and from studies of the production records of crops and livestock. It is taken for granted that one wishing to farm successfully will provide and use one of the easily available record books designed to give a complete account of the year's transaction. One can not correct mistakes unless one knows the source or causes of them.

AVOID RISKS. (To avoid risks is a second requirement.) Farming is attended by many risks. Some are beyond the control of the operator and must be left to chance. Others are within his control if foresight, knowledge, and good judgment are used.

In crop-growing the risk of low yield or crop loss can be avoided by the proper preparation of the soil and seed bed for the crop to be raised. Plant-disease risks can be reduced by suitable crop rotations that lessen the chances of infection from soil borne spores or bacteria. They can be further reduced by suitable seed treatment before planting and by sprays during the growing processes. Insect pests can be controlled in many instances by sprays or poisoned bait. Danger from flooding may be reduced by providing drainage ditches or tile lines, and the effects of drouth can often be reduced by good tillage methods. Plants must be fed if satisfactory growth is to be made. It is unwise to expend seed and labor on land low in fertility unless supplemental plant food is provided in the way of manures or fertilizers. Further risk can be avoided by the selection of crop varieties that will mature in a normal season. Disease-resistant varieties are often available at a slight premium over common varieties. Their use is good insurance against losses from disease. Perhaps enough instances have been cited to illustrate how vital a part the operator plays in successful crop production, but the list of remedies is by no means complete. The efficient and resourceful operator will find many more ways to reduce the risks in crop production.

There is little use in growing crops unless they can be safely harvested and securely stored. Matured crops are always subject to injury by hail or bad storms. The sooner after maturity they can be harvested, the less the risk. A day's delay may mean serious damage to quality or complete loss in some instances. Hay and grain are often cured in the field and stacked when dry. Unless carefully handled, there may be loss and damage in the curing

process or in the stacks. Well-built stacks or stacks protected by waterproof covering will preserve the product indefinitely, though still subject to injury by heavy winds or by fire. Even in the barn or granary there is risk of loss from rodents, vermin, and leakage from bins. All such losses can be reduced or avoided by the careful, foresighted operator.

Livestock production also is beset with risks, some of which at least can be controlled or reduced. It is often noted that accidents to livestock are much more frequent on some farms than on others. This fact may be due to a number of causes. Among the most common ones are poorly designed buildings, faulty floors, whether of wood or cement, or yards and paddocks improperly laid out and carelessly fenced. Barbed-wire entanglements rather than fences are too frequently found around barnyard enclosures. These often result in trapped colts with cut feet or legs, and in split teats or ugly wounds on valuable cows or other stock. As with crops, there are disease risks in livestock production. Here, also, foresight and good management can greatly reduce them. Clean barns and yards and careful disinfection of diseased animals and quarters, with isolation of contagious or infectious cases, are necessary. Sanitary measures followed in feeding and management, even to the management of pastures, will pay big returns in animal health. It is easier to let these matters go, but the profits and satisfactions, unfortunately, are likely to go with them, if neglected.

Insurance Against Losses. It is not possible to avoid all risks entirely. There are certain risks, however, that can be covered by moderately-priced insurance which, in event of loss by fire, tornado, or other calamity, will yield at least partial compensation for the loss sustained. Crop-insurance contracts are quite commonly available, either through farmers' co-operative insurance companies, old-line insurance companies, or through the provisions of the crop insurance offered by the Federal Government under the authority of the United States Department of Agriculture. While in the long run the cost of insurance just about equals the indemnities paid, it is good policy to carry reasonable coverage with a view to sharing the risk and gaining the advantage of ready cash for replacement, should loss occur.

(Prevention of Waste is also a function of a good operator.) There is some waste under the best of conditions. Under a careless operator the waste may equal or cancel the profits. Some of these wastes may well be noted to illustrate how they occur.

A look around most farms will reveal plenty of them. An inspection of mangers and feedboxes will indicate something of the efficiency of the feeder and his knowledge of the requirements of his charges. Hay tramped under foot does the animals no good. Too much hay is not only wasteful of feed, but it is injurious to horses. Grain left in the feedbox after feeding indicates illness or poor condition of the animals or overfeeding. The full value of the feed is not recovered in any case. Sour feed, moldy hay, and weathered fodder are other sources of loss. Corn tramped into the mud in the hog yard would yield more pork if fed on a dry feeding floor. Unused skimmed milk, ungathered and dirty unsalable or unusable eggs are also sources of loss. The fields often show unharvested crops or grain wasted from poor cutting or shocking. Only little things, you say? Yes, but the old Scotch proverb still holds, "Mony a mickle makes a muckle." Waste may kill the profits.

MANAGEMENT OF LABOR AND POWER

Labor is one of the first costs in most farm operations. The farmer does not always recognize his own labor nor that of his family as a cost, because it is seldom paid for in cash. The labor performed by the family, however, is paid for indirectly by the food they eat, the shelter at their disposal, and the clothing and other commodities provided from the farm income. The time of the operator has value and should be wisely used. The expectation is that he should earn at least as much from working on his farm as he could earn if employed for a cash wage by some other farmer or in some other business or industry.

Employ Labor Productively. The management of labor is one of the most important functions of the operator. It must be employed as largely as possible on those projects or farm enterprises that will yield income in cash or in commodities for use. Labor expended in caring for growing crops, or livestock, in milking cows, or in feeding and caring for pigs or chickens is said to be employed productively. That is, the crops grown or the commodities made will produce income for the operator, because there will be something to sell or use from its employment. On the other hand, labor expended in mowing lawns, painting buildings, and tidying up the farmyards and fences is not expected to yield income or at most only an indirect income not available for use.

Estimates based on studies of farm costs over a period of years indicate that 40 per cent or more of the cost of growing

small-grain crops is for labor. Over 50 per cent of the cost of growing corn or potatoes is labor cost, and hay-crop costs are in nearly as high proportion. Livestock production costs may be largely controlled by the operator. Efficient labor employed on highly productive stock may pay good returns. Expended on low-producing animal units, it may pay very low returns. Labor used on dairy cows yielding 300 to 400 pounds of butterfat per year will earn a good income. The same labor spent on cows giving 200 pounds or less will earn little or no income. Frequently the product made from poor cows is worth less than the feed cost, and no wage whatever is earned for the labor expended. The operator will do well to center his attention on the application of available labor to the highly productive enterprises of his farm and to limit as far as possible the amount of labor expended upon low-return or nonproductive enterprises. Studies of profitably-operated farms show, as explained in Chapters XVII and XXI, that farm income is derived largely fom well-directed and well-distributed labor on productive enterprises from which good wages and good profits are earned throughout the year. Good farming and good management of labor are closely bound together.

Machinery Replaces Hand Labor. American farmers use power machinery and implements generously in their farming operations. Power and machinery inventories run high on modern commercialized farms. The object is to do, with power and machinery, work that was formerly done by horses and hand labor. Incidentally, it is hoped that costs of production may thus be lowered or more work accomplished. Power and machines, as with labor, can be profitably used only when fully employed on productive enterprises. Whether or not to buy a tractor, a corn husker, or a feed grinder, depends on the work there is for the tractor or the machine to do. Only the operator of the individual farm can determine what the chances are that the investment will pay returns. One should figure the costs for doing the work without the machine and with it. And the costs in interest, depreciation, and repairs for the machine should not be overlooked. These will have to be covered if the machine is to pay its way. To buy a tractor or other expensive machine, because the neighbors have one, is not the answer to the problem. Machines in the long run are paid for by the productive work they do. If they are to add anything to the net farm income, there must be productive employment for them.

Timing the Operations. *On time* at the *right time* should be

the aim of the operator. There is a *best time* for nearly every important farm operation. Labor can be saved in crop-growing by timely preparation of the soil. Throughout the Northwest early-seeded crops give the best yields. Early seeding can not be accomplished unless plans are made and the seed bed at least partially prepared the fall before. The one who waits until seeding time to put his machine in order and clean his seed grain will find that he is not on time with his seeding. A day or two of delay in starting the cultivators often means a tough battle with weeds before the end of the season. A few hours' delay in the hay field may mean spoiled hay and poor feed. So one might go through the numberless operations connected with growing crops and point out instances of loss due to *failure* to be *on time*.

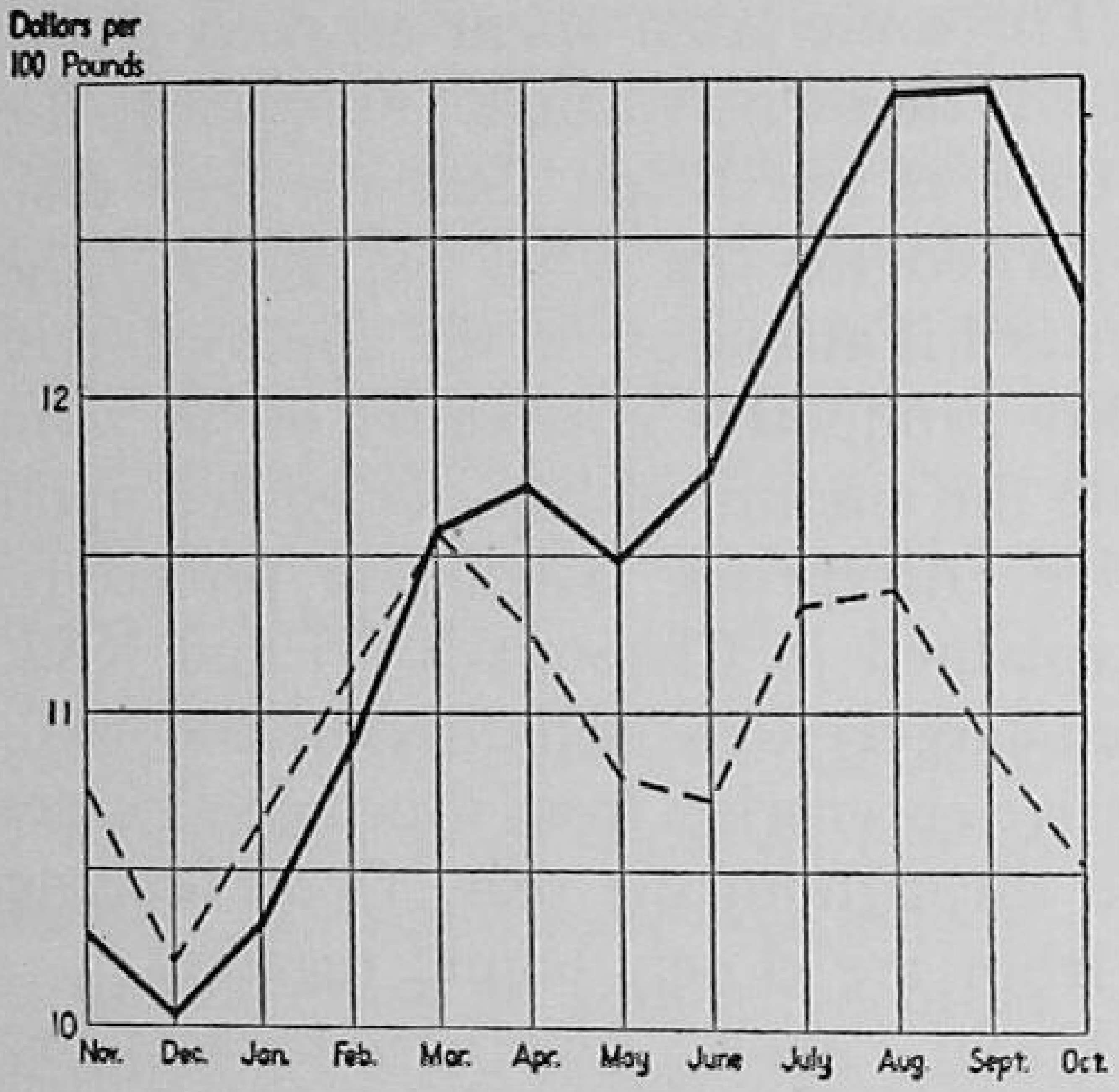

Figure 23. Hogs: Average Monthly Top Prices, Chicago, in 21 Years of Decreasing Production and 14 Years of Increasing Production, 1901-1936.[1]
The heavy solid line is the average of the deflated prices in the 21 years of decreasing hog production. The broken line is the average of deflated prices in the 14 years of increasing hog production. The actual prices have been deflated by the Index of Wholesale Prices of All Commodities of the Bureau of Labor Statistics.

[1] *Minnesota Technical Bulletin 127*, Fig. 7, p. 28.

It is just as important to be on time with the livestock enterprises. The program for livestock production should be planned well in advance. If it calls for winter dairying, breeding operations must be so timed as to bring the cows into milk in the late fall or early winter months. Every good dairyman knows the importance of correct timing and regularity in feeding and milking dairy cows. The same logic applies to hog-raising. Studies of market and outlook reports will enable one to so time pig farrowings as to bring sale stock into the market at a favorable price period. Delays in docking lambs, dehorning calves, or castrating young males intended for market, not only increase the death risks, but often affect adversely the marketability of the stock. These matters all lie within the con-

trol of the operator. Some farmers succeed better than others because they look ahead farther and so time their operations and activities as to give them the greatest possible advantage in labor or feed savings and in meeting market demands.

KEEPING THE FARM IN ORDER

Everyone admires a well-kept farm. While appearances do not always indicate the earning power of the farm, they do tell a great deal about the operator. And they also affect the sales value of the farm. The buildings need not be large or pretentious, but they should be neat and well kept. Hinges are provided for doors to swing on. It does not take a skilled mechanic to tighten the screws or bolts that hold them in place or to replace one if broken. It is surprising, too, what a few drops of oil applied to a rusty hinge or bolt will do in easing the swing or stopping noise. Windows are put in barns to let light in and keep cold out. Light will enter through the hole left by a missing or broken pane of glass, but so will the cold. Winter or summer, broken window lights indicate shiftlessness and lack of care. These attentions and adjustments are not must jobs, nor do they promise any returns in income. They can be done at odd times, on rainy days or in slack times at very little expense. The reward will be found in the satisfaction growing out of operating a well-kept farm. There is sale value also in a good reputation for the farm. Neat fences are safer for livestock enclosed and improve the appearance of the farm. Clean fields and roadsides add to the reputation of the farm and reduce the cost of operating. Noxious weeds left to spread reduce yields, increase the cost of operating, and depreciate the selling value of the farm Finally, painted well-appointed buildings are always attractive to passers-by and a source of pride, comfort, and satisfaction to those who own or operate the farm. Even if new paint can not be provided, cleanliness, neatness, and good order can be in evidence.

As may be seen from the foregoing, farming is divided into two phases, *organization* and *operation*. The first has to do with the long-time layout of the farm, the type of farming followed, and the proportions and relationships of the parts that make up the farm unit. The second phase relates more particularly to the short-time or immediate plans and to the everyday activities involved in farming. Farm organization was fully treated in Chapters XI and XII. Attention will be given in the following chapters to matters leading to efficient farm operation.

CHAPTER XIX

DETERMINING THE RESULTS FROM OPERATION

(A good set of farm records is the best guide to farm operation.) These records will tell the farmer how successfully he has carried out his organization plan. They will tell him whether he has made any financial progress during the year. Not only that, they will tell him whether a lack of financial progress is due to low earnings from the farm operation or to large personal expenditures. A careful study of these records will bring out most of the elements of strength and weakness in the organization plan and in its operation. The more complete the system of records, the greater will be its value to the farmer as a guide to successful operation. More attention will be given to methods and objectives of farm accounting in Chapter XXVIII.

TABLE XXX—SUMMARY OF OPENING AND CLOSING INVENTORIES OF A SOUTHEAST MINNESOTA DAIRY FARM

Classes of Property	Value at Beginning of Year	Value at End of Year
Land	$ 5,428.00	$ 5,428.00
Buildings and improvements	7,072.00	6,875.00
Machinery and equipment	1,814.35	1,846.43
Feeds, seeds, and supplies	1,125.93	1,130.45
Work horses	870.00	735.00
Cattle, hogs, and poultry	2,003.50	2,019.45
Total value of farm property	$18,313.78	$18,034.33

CHANGES IN FARM ASSETS. A complete inventory of all farm property taken at the beginning of each year is the first essential in determining financial progress. A summary of the inventory values for the Southeast Minnesota Dairy Farm discussed in Chapter XIII is shown in Table XXX. The total value of farm property declined nearly $300 during the year. Much of this was the result of the decrease in building values. Depreciation is a method of charging off each year of its useful life a part of the original cost of the building. Unless offset by substantial amounts spent for repairs or new construction, there is some depreciation in building values each year. Farm machinery is depreciated

annually in the same manner, but in this particular case new purchases more than offset the normal rate of depreciation. The only other important change during the year was in the value of work horses. One horse died during the year and several others declined in value because of age.

Buildings and machinery must be maintained by regular repairs and replacements or in a few years the farmer will find that a large part of his investment has disappeared. Likewise replacements must be raised or purchased if the livestock organization is to be maintained.

Changes in Net Worth. The inventory changes in the value of farm property alone do not tell the whole story as to the farmer's financial progress. The farmer commonly has some personal assets in addition to those used exclusively in the farm business. He may also have liabilities that cancel out some of his assets. A complete net worth statement showing both farm and personal assets and liabilities is shown in Table XXXI.

TABLE XXXI—Net Worth Statement, Southeast Minnesota Dairy Farm

Item	Value at Beginning of Year	Value at End of Year
Assets:		
Farm property (Table XXX)	$18,313.78	$18,034.33
Stock in cooperative creamery	100.00	100.00
Stock in cooperative elevator	100.00	100.00
Agr. Conservation payment due	41.50	180.80
Due on bull sold	....	50.00
Outside property owned	500.00	500.00
Household and personal goods	900.00	900.00
Cash surrender value, life insurance policies	325.00	375.00
Cash on hand and in bank	287.00	236.06
Total Assets	$20,567.28	$20,476.19
Liabilities:		
Real estate mortgage	$ 3,000.00	$ 2,700.00
Note at bank	1,000.00	1,000.00
Owing on corn shredder	....	39.00
Owing on cow purchased	....	55.00
Owing on doctor bill	44.00	40.00
Owing on grocery account	25.10	10.85
Total Liabilities	$ 4,069.10	$ 3,844.85
Net Worth	$16,498.18	$16,631.34

The net worth statement shows that the value of all assets owned by the farmer decreased slightly during the year. The decrease in farm assets has already been noted in Table XXX

and a decrease in cash on hand is shown in this statement. These decreases are only partially offset by increases in accounts receivable and in the cash value of life insurance policies. On the other hand, liabilities or claims against these assets decreased during the year. The principal of the real estate mortgage has been reduced, although this was partially offset by an increase in accounts payable at the end of the year. The net result is an increase of $133.16 in net value of all property owned by the farmer. This represents his financial progress for the year, even though his bank balance shows a decrease. He has no more property than before but the liabilities have been reduced. A farmer may increase his net worth either by increasing his assets or decreasing his liabilities.

Determining the Net Income. The net worth statement tells whether the farmer has made financial progress during the year, but does not tell why. A record of receipts and expenditures is necessary for a complete analysis. A summary of farm receipts, farm expenditures, and net farm income for this farm is shown in Table XXXII. In this table is shown all income received from the sale of farm products and the services of the farm labor force and equipment. The expenses include all cash outlay incurred in connection with the farm business. Some of these, such as new machinery purchases and the principal payments on the mortgage, represent capital investments rather than current operating expense but are paid out of current income or from savings. As already shown in Table XXXI, some of the cash income resulting from farm transactions during the year, such as part of the price to be received for a bull that was sold, was not received by the end of the year. It is shown as an account receivable at the end of the year in the net worth statement, but is not included in the cash income received. Likewise, purchases such as the corn shredder show in the cash expense statement only insofar as they were paid for during the year. Any amounts still due appear as bills payable at the end of the year.

The actual amount by which cash farm income exceeded cash farm expenditures was $1,500.72. This amount, coupled with the cash the farmer had at the beginning of the year, is the amount of money available for personal and family living and savings.

Personal and Household Expense. A record of personal and household expense is needed to complete the analysis of the financial status and progress of the farmer. A list of personal, and household expenses is shown in Table XXXIII. The actual cash

outlay for living expenses exceeded the net cash income from the farm by $50.94 ($1,551.66 minus $1,500.72). This is reflected in the decrease of this amount in cash on hand. It was necessary to draw on the cash reserve to meet the personal expenses. How-

TABLE XXXII—SUMMARY OF FARM RECEIPTS, FARM EXPENSE, AND NET FARM INCOME

Farm Receipts:		
Dairy products	$1,120.03	
Cattle	738.69	
Hogs	1,059.12	
Poultry and eggs	501.78	
Crops	66.61	
Income from work off farm	112.34	
Agricultural Conservation payment	41.50	
Miscellaneous	12.70	
Total Farm Receipts		$3,652.77
Farm Expenses:		
Livestock purchased	$ 184.50	
Feed	209.90	
Other livestock expense	36.70	
Crop expense	293.31	
Hired labor	112.82	
Buildings and fences (new—$7.00, repairs—$84.27)	91.27	
Machinery (new—$107.75, repairs and expense—$125.98)	233.73	
Tractor (hired)	85.31	
Auto (farm share)	55.15	
Electricity (farm share)	29.66	
Taxes	219.44	
Interest	185.00	
Payment on real estate mortgage	300.00	
Insurance	93.46	
Miscellaneous	21.80	
Total Farm Expense		$2,152.05
Net Farm Income		$1,500.72

ever, if all bills incurred during the year had been paid and all income that accrued as the result of the year's operations had been received, this would not have been necessary. The cash on hand could have been maintained. It has already been noted that some of the cash payments shown in Table XXXII are capital outlay and are reflected in increased net worth at the end of the year. The insurance premiums listed as personal expense likewise contribute to an increased cash surrender value of the life insurance policies at the end of the year. In addition to the items of family living listed in Table XXXIII, the farm family had the use of a house, all cash expenses for which are included in the farm income and expense statement. Furthermore they had a substantial amount of their food and fuel furnished by the farm.

The value of this contribution is shown in Table XXXIV. These items are valued at the wholesale price at the farm. If purchased at retail they would cost approximately twice this amount.

THE RETURNS TO INVESTMENT AND FAMILY LABOR. These records show that as the result of the year's operations this farm

TABLE XXXIII—PERSONAL AND HOUSEHOLD EXPENSES

Food	$ 394.71
Clothing	140.63
Furnishings and equipment	75.77
Operating and supplies	34.44
Health	50.20
Education	77.85
Church and charity	106.95
Life insurance	295.17
Personal expense	124.03
Gifts	75.39
Auto (personal share)	117.20
Electricity (personal share)	59.32
Total	$1,551.66

family had $1,551.66 for personal expenditures. In addition their net assets increased $133.16. They also received the use of a substantial farmhouse and a considerable amount of food that had been produced on the farm. The total net income was $1,684.82 in cash and increased net worth, an estimated rental value of the house of $315 (10% of the current appraised value), and farm produce worth $286.93, or a total of $2,286.75. This represents the net return for the labor and management of the father and two grown sons and the use of property with a capital value in excess of $16,000. If we assume that 5% is a fair charge for the use of the capital and deduct $800.00 (5% of $16,000) from the total net income above, $1,486.75 is left for the labor and management, or not quite $500 per man. This is just about what they might have expected to earn as hired men without assuming any risks or the burden of management.

The analysis in this chapter merely indicates how the farmer may determine his financial status and progress through the use of farm records. It does not tell why the earnings are large or small. The next chapter deals with the further use of records in finding out the factors that limit or determine earnings and also with their use as a guide to current adjustments in the farm plan that will lead to more successful operation.

TABLE XXXIV—Farm Produce Used in the House

Item	Amount	Value
Milk	1922 qts.	$ 48.35
Cream*	116 pts.	12.16
Eggs	132 doz.	22.94
Poultry, 59 head	176 lbs.	21.16
Hogs, 4 head	1050 lbs.	74.42
Potatoes	47 bu.	22.90
Fruit and vegetables		35.00
Farm produced fuel		50.00
		$286.93

* Butter used by the family was obtained from the creamery, which made a cash deduction from the cream check. The amount of this deduction is included in the food item in Table XXXIII.

CHAPTER XX

MEASURES OF MANAGEMENT IN FARM OPERATION

While the farmer is naturally interested in knowing his earnings and his financial progress, that knowledge alone does not satisfy him. He is even more concerned with the reasons why his earnings are high or low and with what he can do to improve his business and thereby his financial progress and his standard of living. Farm records will tell him these additional things, but more information is needed for these records than was presented in the previous chapter. Such information must include not only a more detailed account of his own business activities but also a comparison of these activities with the results from other farms.

VARIATIONS IN EARNINGS. All studies of farmers' earnings bring out the fact that the earnings of a particular farmer vary widely from year to year and also that within a given year there is a wide range in earnings among different farmers in the same community. Some farmers are very successful while their neighbors are suffering large losses. This may be true even though all are farming the same general types of soil, are subject to the same weather conditions, sell their products in the same markets, and buy their supplies from the same sources. This variation is illustrated graphically in Figure 24. This graph summarizes the labor earnings of a group of southeastern Minnesota dairy farmers in 1938. Each bar represents one farm and the height of the bar indicates the amount of earnings. The upper 20 per cent in the range had an average labor earning of $3,439. Those in the lower 20 per cent, in addition to receiving no return for their labor, failed by over $500 of having enough income to cover the other expenses charged against the farm business. There was an extreme range of over $12,000 between the highest and lowest earnings, although most of them varied within a range of approximately $2,000. For the past 17 years the average range in earnings from high to low for a group of farmers similar to those shown in Figure 24, and including many of the same men, was $9,720. Every year during this period, even the most unfavorable ones, some farmers made substantial earnings, whereas every year except two there were some farmers who failed to cover all the

other costs involved and had no return at all for their labor. Studies of the earnings of farmers of other types and in other states reveal similar wide ranges in earnings among farmers within a limited area in a given year.

MANAGEMENT FACTORS AFFECTING FARMERS' EARNINGS

A large proportion of the variation in earnings is due to factors under the farmer's control. Variations in earnings of the same farmer from year to year may be caused by differences in

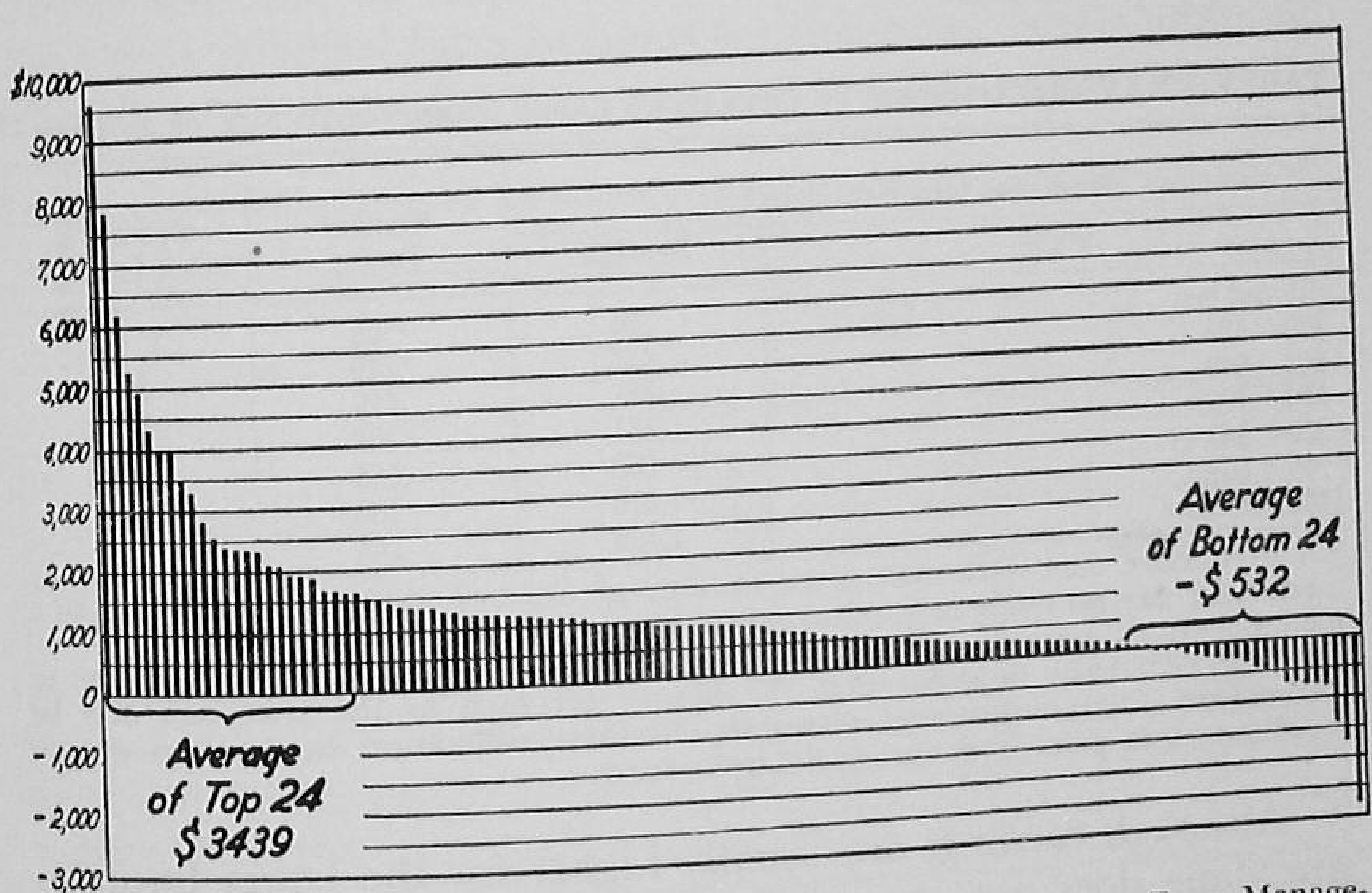

Figure 24. Range in earnings of co-operators, Southeast Minnesota Farm Management Service, 1938. The top fifth of these farmers averaged about $4,000 more per man than the bottom fifth.

weather, prices, or other factors outside his control, but the variations among farmers in a community within a given year are due principally to differences in the organization and methods of operation. These factors affecting earnings may be grouped into four classes: (1) size of business, (2) organization of business (choice of crops and livestock), (3) rate of production or yield, and (4) efficiency in production. The farmer who wishes to increase his earnings should analyze each of these factors as it applies to his business to determine the weakness in his business and the opportunities for improvement. Most of the calculations involved are relatively simple and the time required is not great.

SIZE OF BUSINESS

One of the most important factors affecting the farmer's earnings is size of business. In years when farmers are receiving normal returns from their operations, the returns tend to be largest for those farmers who have the largest volume of business. This relationship of earnings to size of business is illustrated in Table XXXV. Cost of machinery and buildings does not increase in proportion to the size of the farm business. Labor and power can generally be used more efficiently on large farms. More favorable prices can frequently be obtained when buying and selling in large quantities.

TABLE XXXV—RELATIONSHIP OF OPERATOR'S LABOR EARNINGS TO SIZE OF BUSINESS[1]

Productive Man Work Units*		Number Farms	Operator's Labor Earnings†
Group	Average		
349 and less	296	65	$ 921
350– 499	434	249	1,101
500– 649	581	429	1,481
650– 799	721	308	1,733
800– 949	868	165	2,213
950–1,099	1,020	100	2,491
1100 and more	1,395	146	2,977

* A productive man-work unit is the average amount of work done by a man in a ten-hour day on crops or productive livestock, or both.

† All operator's earnings data in this and succeeding tables have been reduced to a 1928-1929 basis in order that the figures for each of the ten years may be combined. This adjustment serves to eliminate differences in earnings due to differences in price level among different years.

Although earnings are usually higher for the larger business, size alone does not ensure high earnings. Size is an advantage only if the farm is well organized and efficiently operated. A large business of low quality is more likely to result in loss than in high earnings. In periods when prices are so unfavorable for the farmer that losses are inevitable, the losses will be greater for the large farm than the small. This is indicated in the data presented in Table XXXVI for the same farms which are compared in Table XXXV. In 1930 size of business was no advantage, and in 1931 and 1932, when most of the farmers had insufficient income to cover the costs charged against the business, the farmers with large businesses incurred the larger losses. However, for the ten-year period, even though it included some of the most

[1] Southeast Farm Management Service, 1928-1937. This table and similar tables that follow are taken from *Bulletin 386*, Minnesota Agricultural Experiment Station.

unfavorable years that agriculture has ever experienced, the farmers with the larger volume of business had much higher average earnings. In general it may be said that larger size offers the opportunity for larger earnings. There is more risk involved in the large business. It calls for more managerial ability. The farmer with ability and capacity can make more with the large business, but the operator limited in these qualifications is likely to find a moderate size of business safer and more profitable.

ORGANIZATION OF THE FARM BUSINESS

The selection of crops and livestock and their combination into a well-balanced farm business are important factors affecting a farmer's earnings. In every area natural and economic conditions are such that certain crops and kinds of livestock contribute more to the farmer's earnings than do others. Changes in economic conditions and in methods of production may change the relative advantage of the various crop and livestock enterprises, and the farmer must keep his organization adjusted to these changes.

TABLE XXXVI—RELATION OF OPERATOR'S LABOR EARNINGS TO SIZE OF BUSINESS BY YEARS, 1928-1937

Year	Productive Man Work Units		
	499 and Less	500–799	800 and Over
1928	$ 837	$1,277	$2,256
1929	1,274	1,884	2,809
1930	182	245	173
1931	--237	—659	—842
1932	—527	—748	—1,013
1933	443	792	1,446
1934	701	1,575	2,624
1935	650	1,228	2,091
1936	1,280	2,506	4,135
1937	664	1,190	2,106
Average	$ 527	$ 929	$1,579

Choice of Crops. The importance of choice of crops as a factor affecting earnings is illustrated in Table XXXVIIB. The measure of crop selection used is the percentage of the cropland in high return crops. The farmer's earnings increased steadily with an increase in the proportion of the cropland in high return crops.

Index of Crop Selection. The kinds of crops grown can be effectively compared by means of an index of crop selection. In

calculating the index of crop selection, the crops grown in the community must first be classified into groups. The factors to be considered in the grouping are: (1) nutrients produced per acre of feed crop, (2) per cent protein in feed crops, (3) cost of producing a unit of digestible nutrients, (4) net return per acre for

TABLE XXXVIIA—CALCULATION OF THE INDEX OF CROP SELECTION [1]

Crop	Acres	Classification of Crop	Weight Value	Weighted Acres
Oats	17.6	D	0	....
Barley	9.4	B	½	4.7
Oats and barley	9.2	C	¼	2.6
Oats, barley and wheat	22.0	C	¼	5.5
Wheat	5.4	C	¼	1.4
Ear corn	17.2	B	½	8.6
Silage corn	12.6	C	¼	3.2
Beets and potatoes	1.1	A	1	1.1
Alfalfa, timothy, and clover	4.2	B	½	2.1
Alfalfa and timothy	13.9	B	½	7.0
Timothy and clover	.9	C	¼	.2
Sweet clover and timothy pasture	19.2	C	¼	4.8
Alfalfa and timothy pasture	1.2	B	½	.6
Total	133.9			41.8

$$\text{Index of crop selection: } \frac{41.8}{133.9} \times 100 = 31.2$$

[1] Southeast Minnesota Dairy Farm.

TABLE XXXVIIIB—RELATION OF OPERATOR'S LABOR EARNINGS TO INDEX OF CROP SELECTION, 1928-1937

Index of Crop Selection: Group	Index of Crop Selection: Average	Number Farms	Operator's Labor Earnings
19 and less	16.3	41	$1,188
20-25	23.2	122	1,423
26-31	28.7	256	1,527
32-37	34.5	391	1,581
38-43	40.5	348	1,880
44-49	49.6	185	2,043
50 and more	55.4	119	2,425

cash crops, and (5) the effect of the crop on the land. After preparing this classification, the method of calculation is illustrated in Table XXXVIIA. The crops grown on tillable land in southeastern Minnesota have been classified into four groups: A, B, C, and D crops. The particular crops which would be included in each of these classes will vary among different areas. In this

area, the A crops were given a weight of 1, the B crops ½, the C crops ¼, and the D crops 0. The number of acres of each crop is multiplied by the weight. These weighted acres are then added, the sum is divided by the total acres of tillable land, and the quotient is multiplied by 100.

The index of crop selection can be interpreted as the per cent of the tillable land which is used for high return crops. This index on the Southeast Minnesota Dairy Farm was 31.2 The average index of 122 successful dairy farms in this same area was 41.3. This farmer used a far smaller proportion of his tillable land for high return crops than other farmers in this area. He had a less desirable cropping system.

TABLE XXXVIII—Relation of Operator's Labor Earnings to Animal Units of Productive Livestock per 100 Acres, 1928-1937

Animal Units of Productive Livestock per 100 Acres		Number Farms	Operator's Labor Earnings
Group	Average		
09.9 and less	7.9	35	$1,093
14.0-13.9	12.5	172	1,589
1.0-17.9	16.1	371	1,639
18.0-21.9	19.8	423	1,661
22.0-25.9	23.7	256	2,004
26.0 and more	30.5	205	2,034

Choice of Livestock. The choice of livestock is also an important factor conditioning farmers' earnings, but it is not quite so closely tied to the natural conditions on a particular farm as is crop choice. No measure or index of livestock selection was available for the group of farms used to illustrate the principles presented in this chapter. Only dairy farms were selected for this study and hence the pattern of livestock selection was fairly uniform. The number of units of livestock per 100 acres also serves as a measure of farm organization in that it indicates intensity of livestock production. The effect of the number of livestock units on operators' labor earnings is illustrated in Table XXXVIII. The earnings increased with increases in the number of animal units of productive livestock per 100 acres, up to 26. Beyond that point earnings showed only limited response to increases in intensity of livestock production.

RATES OF PRODUCTION

All farm accounting studies reveal a close relationship between earnings and crop yields and rates of livestock production. High

yields of crops are due to the high natural productivity of the land and to the practices followed in production. Likewise high livestock production is due to the quality of the livestock and the practices followed in handling them. Choosing a productive farm and selecting livestock on the basis of their capacity and

TABLE XXXIX—RELATION OF OPERATOR'S LABOR EARNINGS TO INDEX OF CROP YIELDS, 1928-1937 [1]

Index of Crop Yields		Number Farms	Operator's Labor Earnings
Group	Average		
62 and less	56	34	$1,203
63- 77	72	150	1,308
78- 92	86	355	1,470
93-107	100	445	1,739
108-122	115	317	1,993
123-137	129	116	2,302
138 and more	145	45	2,681

efficiency are the first steps in securing high rates of production. Following the best practices in crop and livestock production is equally important and constitutes the vital element in farm operation. Within the range of the usual rates of production in any area the increased costs involved in following good crop and livestock practices are, in general, less than the value of the additional product. Many of the good practices involve no additional outlay, merely more knowledge on the part of the operator and more skill and energy in its application.

CROP YIELDS. The relationship of crop yields to earnings is

[1] *Index of crop yields*—The level of crop yields on different farms may be readily compared in terms of an index of crop yields. An index above 100 indicates yields above the average of the community and an index of less than 100 denotes lower than average yields. The method of calculating the index of crop yields is illustrated in the following table:

Crop	Acres on This Farm	Yield per Acre on This Farm	Total Production on This Farm	Yield per Acre in Community	Acres Required with Average Yield
Corn	40	45 bu.	1800 bu.	40 bu.	45
Oats	25	48 bu.	1200 bu.	50 bu.	24
Barley	15	30 bu.	450 bu.	25 bu.	18
Alfalfa	25	3 tons	75 tons	2½ tons	25
Total Acres	105				112

$$\text{Index of crop yields } \frac{105}{112} \times 100 = 107$$

illustrated in Table XXXIX. The yields are expressed as an index. This index indicates the relationship of the yields on a particular farm to the average for the whole group. The index of 56 for the lowest group means that the average yield for this group of 34 is only 56 per cent of the average for the 1,462 farms

TABLE XL—RELATION OF OPERATOR'S LABOR EARNINGS TO POUNDS OF BUTTERFAT PER COW, 1928-1937

Pounds of Butterfat per Cow		Number Farms	Operator's Labor Earnings
Group	Average		
149 and less	136	46	$1,102
150-189	174	191	1,519
190-229	210	390	1,670
230-269	250	449	1,752
270-309	287	279	1,987
310-349	326	80	2,009
350 and more	371	27	2,155

included in the table. Crops represent the basic part of the farm production program. The higher the crop yields the more product there is to sell directly or to market through livestock. Since earnings increase directly with crop yields, it is apparent that costs have not increased in the same proportion as has production.

LIVESTOCK PRODUCTION. Rates of livestock production are an important factor in determining livestock profits and also the level of farm earnings. This is illustrated in Table XL. Sale of dairy products was the principal source of income on these farms, and the rate of butterfat production per cow had a marked effect on farm earnings. High efficiency in production would have the same effect on earnings from other classes of livestock. The number of eggs per hen, for example, is one of the most important factors determining the earnings of poultry farmers.

EFFICIENCY IN PRODUCTION

(Efficiency in production is an important factor affecting earnings. Efficiency may be defined as the ratio between output per unit and input per unit.) The more eggs or milk or meat that a farmer can produce per 100 pounds of feed, the larger will be his profits. The more labor he can accomplish per man or per machine or per power unit, the lower will be the cost per unit and the greater the net return. Efficiency can be measured in many different ways for different farm enterprises and operations. Three

examples are presented here to illustrate the effect of efficiency on earnings.

FEEDING EFFICIENCY. The relationship of earnings to efficiency in feeding livestock is illustrated in Table XLI. The return over feed cost per unit of livestock is used as the measure of efficiency. This has been reduced to an index basis. Since the costs of items other than feed do not usually increase in proportion to the increased return, the net profit from the livestock, and the farmer's earnings increase with increased feeding efficiency.

TABLE XLI—RELATION OF OPERATOR'S LABOR EARNINGS TO INDEX OF RETURN OVER FEED COST FROM LIVESTOCK OTHER THAN COWS, 1928-1937

Index of Return over Feed Cost from Livestock Other Than Cows		Number Farms	Operator's Labor Earnings
Group	Average		
24 and less	16.9	55	$1,196
25-34	29.9	151	1,365
35-44	39.9	336	1,590
45-54	49.4	424	1,759
55-64	58.8	311	1,994
65-74	68.8	124	1,997
75 and more	83.4	61	2,176

LABOR EFFICIENCY. The acres of crops and the numbers of livestock handled per man are commonly used as measures of labor efficiency. Insofar as the larger accomplishment of labor is the result of better organization and more skillful planning of operations, it results in increased earnings. However, if increased labor accomplishment results in working the land less effectively or giving the livestock less care than is needed for efficient production, it may result in a decrease in earnings. This is illustrated in Table XLII. Ordinarily it is possible to use labor more efficiently on the larger farms. In this tabulation the effect of size has been eliminated by relating the efficiency of each farm to the average for the size group in which it falls. The increases in earn-

TABLE XLII—RELATION OF OPERATOR'S LABOR EARNINGS TO INDEX OF LABOR EFFICIENCY, 1928-1937

Index of Productive Man Work Units per Worker		Number Farms	Operator's Labor Earnings
Group	Average		
74 and less	66	126	$1,304
75-94	86	528	1,386
95-114	103	483	1,885
115 and more	130	325	1,997

ings resulting from the more efficient use of labor, as shown in Table XLII, are largely due to better organization and plans of operation.

EFFICIENCY IN THE USE OF POWER, MACHINERY, AND BUILDINGS. Present-day farming calls for a considerable investment in power and machinery and, for some types of farming at least, a large investment in buildings. The cost of these items constitutes a substantial part of the total costs that must be deducted from gross income in determining the farmer's earnings. The farmer who keeps these items at a minimum consistent with good farming practices and the efficient use of labor will be rewarded with larger earnings. This is demonstrated in Table XLIII.

TABLE XLIII—RELATION OF OPERATOR'S LABOR EARNINGS TO INDEX OF POWER, MACHINERY, AND BUILDING EXPENSE, 1928-1937

Index of Power, Machinery, and Building Expense		Number Farms	Operator's Labor Earnings
Group	Average		
138 and more	158	133	$1,064
108 to 137	119	384	1,665
78 to 107	93	649	1,862
77 and less	64	296	2,056

THE CUMULATIVE EFFECT OF SUCCESS FACTORS

Each of the management factors that have been discussed in this chapter has an independent effect on earnings. The combined effect of a high ranking in all of these factors is very striking. This cumulative effect is illustrated in Table XLIV. The 26 farmers who were below the average of the group with which

TABLE XLIV—RELATION OF OPERATOR'S EARNINGS TO THE NUMBER OF SUCCESS FACTORS IN WHICH THE FARMER EXCELS

Factors Above Average	Number Farms	Average Operator's Earnings
0	26	$ 445
1	113	864
2	203	1,204
3	297	1,507
4	320	1,634
5	258	2,243
6	154	2,471
7	71	2,821
8	20	3,444

they were compared in each of the 8 factors, had an average earnings of $445. The 20 farmers who excelled the average of the group in all of the 8 factors had average earnings of $3,444 or

more than 7½ times as much. To achieve high earnings it is not sufficient to have merely a large business, or high crop yields, or a good choice of crops. Superior management, as evidenced by excellence in all or at least a majority of the factors, is an important essential to attaining a high rating in earnings.

TABLE XLV—RELATION OF FARMER'S EARNINGS TO THE NUMBER OF SUCCESS FACTORS IN WHICH THE FARMER EXCELS

	Farmer's Earnings					
State	Illinois	Indiana	Texas	New York		S. Carolina
Type of Farming	Wheat & Dairy[1]	Dairy[2]	Cotton[3]	Dairying[4]	Poultry[5]	Cotton[6]
No. Factors Used	7	6	6	4	3	3
No. Factors in Which Farmer Excelled						
0	$ *	$ —	$—487	$—85	$—15	$ 25
1	—353	—67†	—309	63	1,263	111
2	200	310	—40	351	2,343	345
3	493	692	103	857	2,552	464
4	607	1,386	377	1,708		
5	1,154	1,624‡	657		....	....
6	1,492		1,099	....	....	....
7	*	....	....	....	....	....

* Data omitted as they cover but one farm.
† Excelling in one or no factors.
‡ Excelling in five or six factors.

[1] From *Bulletin 374,* Illinois Agricultural Experiment Station.
[2] From *Bulletin 452,* Indiana Agricultural Experiment Station.
[3] From *Bulletin 568,* Texas Agricultural Experiment Station.
[4] From *Bulletin 782,* Cornell (N. Y.) Agricultural Experiment Station.
[5] From *Bulletin 803,* Cornell (N. Y.) Agricultural Experiment Station.
[6] From *Bulletin 340,* South Carolina Agricultural Experiment Station.

SELECTION OF MANAGEMENT FACTORS

Management factors affecting the farmer's earnings may be classified into the four general groups already mentioned: (1) size, (2) organization, (3) rate of production, and (4) efficiency. The specific measures to be used under these classifications may vary widely for farms of different types and sizes and for different locations. A selection of crops that is good in one area may not be suited to some other area. Livestock may be an important factor with one type of farming but of no importance with another. However, in any area the farmer who has an ample size of business and a well-planned organization, maintains his production at a high level, and operates efficiently will have materially higher

earnings than the average of all farmers in the area. The data presented in Table XLIV were obtained from dairy farms in southeastern Minnesota. The same method of analysis can be applied to other types of farms in other areas as illustrated in Table XLV. The data in this table cover widely differing types of farming in five states. Different factors were considered in the different states, but each one falls readily into one of the four general classifications already mentioned. The factors must be selected to fit the specific situation and the data upon which to base them must be available, but the general principle is of wide application. The use of these factors in determining the elements of strength and weakness in the organization and operation of an individual farm is discussed in the following chapter.

FACTORS AFFECTING THE RETURNS FROM CROPS AND LIVESTOCK

There are also management factors that affect the returns from crops and livestock similar to those that affect the farmer's earnings. For crops, these include such factors as yield, seed treatment, soil treatment, selection of adapted varieties, adequate seed-bed preparation, timeliness of operations, and efficiency in the use of labor, power, and machinery. Some of these operate to increase production and thereby gross income, whereas others reduce the costs of production.

Similar factors affect financial success in livestock production. This is illustrated in Table XLVI. The factors considered in the case of hogs were (1) pounds of feed needed to produce 100

TABLE XLVI—RELATION OF RETURNS OVER FEED COSTS FROM LIVESTOCK TO THE NUMBER OF MANAGEMENT FACTORS IN WHICH THE FARMER EXCELS

Number of Factors Above Average	Returns Over Feed Costs		
	Hogs[1]	Sheep[2]	Dairy Cows[3]
	(per 100 lbs.)	(per head)	(per cow)
0	$—.53	$—.31	$29.00
1	.11	.20	32.00
2	.68	1.39	38.00
3	1.49	2.51	46.00
4	2.17	3.50	52.00
5	2.42	4.85	59.00
6	2.79	5.22	—*

* Only 5 factors considered.

[1] From *Bulletin 379,* Minnesota Agricultural Experiment Station.
[2] From *Bulletin 382,* Minnesota Agricultural Experiment Station.
[3] From *Bulletin 378,* Minnesota Agricultural Experiment Station.

pounds of hogs, (2) percentage of protein in the ration, (3) the extent to which sanitation methods were followed, (4) percentage death loss, (5) number of pigs weaned per litter, and (6) price received per 100 pounds of hogs sold. The factors considered for sheep were (1) gross returns per head, (2) percentage lamb crop, (3) average value per lamb sold, (4) price received for wool, (5) percentage death loss, and (6) feed cost per head. For dairy cattle five factors were used: (1) pounds of butterfat produced per cow, (2) total digestible nutrients per pound of butterfat, (3) percentage of protein in the T.D.N., (4) the proportion of the T.D.N. received from concentrates, and (5) the percentage of fall freshening.

A large amount of similar information is available in many states. In the case of crops, some of the factors are likely to be of only local significance, since soil and climate affect crops more directly than they do livestock. Some crop factors, such as the effect of yield or efficiency in the use of labor, power, and machinery, are rather generally applicable. Livestock factors are likely to apply much more widely than do many of the crop factors. A fuller discussion of these factors is to be found in both extension and research farm management bulletins of the various states. Their use in checking the efficiency of farm operation is discussed in Chapter XXI.

CHAPTER XXI

MEASURING THE EFFICIENCY OF OPERATION

The management factors that affect financial success in farming have been discussed in Chapter XX. These are often called "efficiency factors." They are very useful tools in checking up on the efficiency with which a farm is organized and operated. They enable the farmer to find the weak spots in his business through a fairly simple and easy process. Knowing the limitations to earnings does not automatically correct them, but such knowledge points out those features of the farm that need attention and study. Efficiency in handling these factors greatly influences the returns from farm operation.

CHANGES IN MANAGEMENT FACTORS FROM YEAR TO YEAR

One use of management factors is to discover changes in the farm business from year to year. Changes register the extent to which the operation of the farm is improving or slipping backward. The process of comparison is illustrated in Table XLVII. The example shows little change in the size of business during the six years covered by these figures. The intensity of livestock operations decreased, as shown by the decreasing number of livestock units per 100 acres. Labor efficiency remained fairly constant except for one year, 1934. During the six years, there was marked improvement in the choice of crops, butterfat production per cow, and livestock feeding efficiency. The last three years showed some improvement in crop yields, and in each of the last five years expenses for power, machinery, and building per unit of work performed were less than in the first year. The most marked improvement was in choice of crops, and the results were a factor contributing to the increased yields and greater feeding efficiency in the later years. The low production per cow and the low feeding efficiency made a decrease in the number of livestock desirable. An increase in the number of livestock with low production and low feed returns subtracts from rather than adds to the earnings. An increase in size of business would not have increased earnings until the factors of management were put on a more efficient basis.

The steady increase in earnings, even if allowance is made for changes in the price level during the period, indicates a favorable response to improved ratings in the management factors.

This type of year-to-year comparison of management factors has certain limitations as a guide to increased earnings. Changes in the price level affect such factors as feeding efficiency, and power, machinery, and building expense, since these, too, are

TABLE XLVII—EARNINGS AND MANAGEMENT FACTORS COMPARED FROM YEAR TO YEAR FOR AN INDIVIDUAL FARM

	1931	1932	1933	1934	1935	1936
Operator's labor earnings..........	$—1,861	$—746	$—552	$1,074	$1,459	$3,160
Management Factors:						
Size, work units...............	755	743	757	679	681	765
Organization:						
Choice of crops..............	23.5	22.2	28.3	24.7	38.4	41.6
Livestock per 100 acres.......	22.3	20.9	20.2	17.7	18.4	19.8
Rate of production:						
Crop index..................	86	79	80	99	87	96
Lbs. B. F. per cow............	171	203	157	190	210	222
Efficiency:						
Return over feed cost per head.	$.35	$13.61	$19.99	$7.45	$67.75	$56.08
Labor units per worker.......	343	338	379	271	324	348
Power, mach. and bldg. expense per work unit......	$1.43	$1.00	$ .83	$1.14	$1.20	$1.32

measured in monetary terms. Although the earnings increased each year, in this case a substantial part of the increase was due to increases in the prices of farm products. Those factors that are measured in physical terms are best for making year-to-year comparisons.

COMPARISONS OF MANAGEMENT FACTORS BETWEEN FARMS

One of the most valuable uses to which management factors may be put is in making comparisons between individual farms and the averages of a group of farms of a similar type operating under the same general conditions as to weather, markets, and general environment. These comparisons can be made independently by years and hence the element of changing price level does not come into the picture in the case of factors measured in monetary terms as mentioned above. This type of comparison is illustrated in Table XLVIII. Factor data for the year 1931 for the farm used in Table XLVII are compared with the average of the same factors for a group of 147 other farms of the same type in the same general area. Comparisons are also made with the 20

per cent of this group ranking highest in earnings and with the 20 per cent ranking lowest. This type of analysis has come into wide use in recent years and, if properly interpreted, may be very helpful to a farmer in detecting and correcting the weaknesses in his business.

It is apparent from Table XLVIII that not only does this farmer have low earnings but that in seven of the eight management factors he also ranks below the average of the 147 farmers

TABLE XLVIII—EARNINGS AND MANAGEMENT FACTORS FOR AN INDIVIDUAL FARM COMPARED WITH GROUP AVERAGES, 1931

	This Farm	Average of 147 Farms	30 Most Profitable Farms	30 Least Profitable Farms
Operator's labor earnings	$—1,861	$—622	$618	$—2,164
Management factors:				
Size, work units	755	776	834	983
Organization:				
Choice of crops	23.5	33.4	37.8	29.7
Livestock per 100 acres	23.3	21.7	23.4	20.5
Rate of production				
Crop index	86	100	113	91
Lbs. butterfat per cow	171	241	263	222
Efficiency				
Return over feed cost per head	$.35	$5.10	$13.59	$—6.30
Labor units per worker	343	354	378	376
Power, mach., and bldg. expense per work unit	$1.43	$1.37	$1.14	$1.60

with records for the same year. In the eighth factor, number of livestock per 100 acres, this farmer ranks above the average, but in his case this serves to decrease rather than increase earnings because of low livestock production and low feeding efficiency. Measured in terms of factor quality and earnings, this farmer ranks in the lowest 20 per cent of the group.

With this information as a guide, this farmer increased his ratings in many of these factors as shown in Table XLVII until by 1936 he compared favorably in factor ratings and in earnings with the average of the group of which he was a part. This is shown in Table XLIX. By 1943, after applying the factor analysis to his business each year since 1931, he had achieved a rating equal to or above the average of the group in six of the eight factors and was 38 per cent higher in earnings. His earnings from 1931 to 1943 increased, relative to those of the farms with which he was compared, in about the same proportion as he increased his relative rating in the success factors. This type of comparison of an individual farm with the average of a group of similar farms in

the same area has a distinct advantage over comparing the factors and earnings of that farm for one year with those of the same farm for another year. As already mentioned, it eliminates the effect of changing price level. In the second place, it is not necessary to wait until two years' data has been accumulated before comparisons can be made. The larger group serves also as a more stable basis of comparison, and the more successful portion of that group supplies a goal or standard of accomplishment.

THE THERMOMETER CHART

The thermometer chart is a simple and effective way of presenting graphically the rating of an individual farmer in the

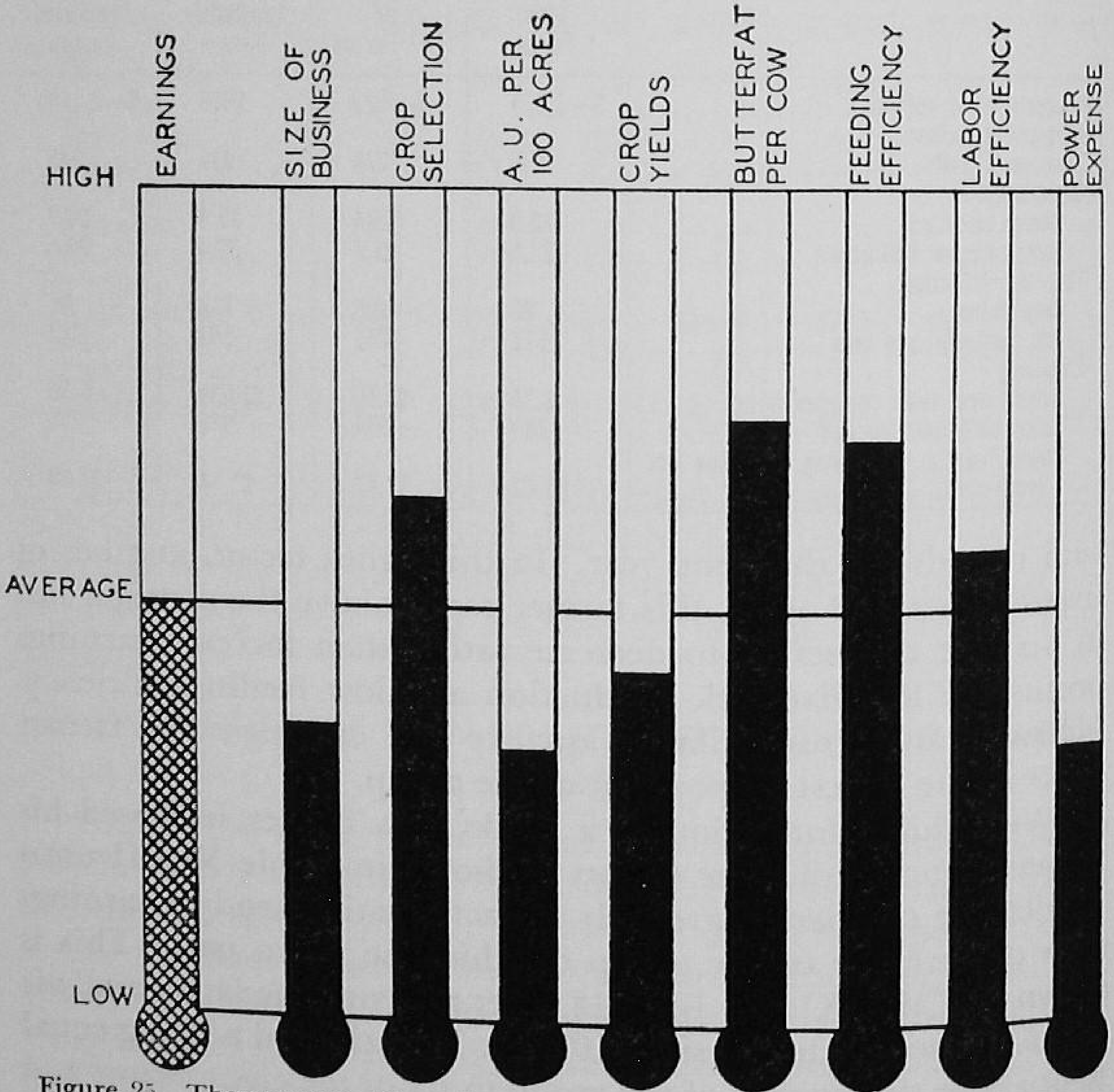

Figure 25. Thermometer Chart for a Farm with Average Earnings. Four of the management factors indicated better than average accomplishment and four showed less. The resultant earnings were approximately equal to the average of the entire group.

management factors discussed in this and the previous chapter. The factors can be visualized much more easily in chart form.

One form of a thermometer chart is shown in Figure 25. The first bar represents the operator's labor earnings. Each of the other bars represents one of the management factors. The heavy black line just above the bulb of the thermometer represents the lowest rating of any of the farmers included in the group. The heavy black line at the top represents the highest rating of any farmer

TABLE XLIX—EARNINGS AND MANAGEMENT FACTORS FOR AN INDIVIDUAL FARM COMPARED WITH GROUP AVERAGES, 1936 AND 1943

	1936		1943	
	This Farm	Average of 152 Farms	This Farm	Average of 177 Farms
Operator's labor earnings	$3,160	$2,914	$6,231	$4,493
Management factors:				
Size, work units	765	763	676	671
Organization				
Choice of crops	41.6	41.7	51.2	41.1
Livestock per 100 acres	19.8	20.1	20.9	25.4
Rate of production				
Crop index	96	100	104	100
Lbs. B. F. per cow	222	243	288	240
Efficiency				
Return over feed cost per head	$56.08	$44.74	$83.84	$71.05
Labor units per worker	348	341	294	305
Power, mach., and bldg. expense per work unit	$1.32	$1.31	$3.84	$2.79

in each factor and the line midway between these the average rating of the group. The figures for a given farmer are shown by shading each bar up to the height that represents the rating of this factor relative to the high, low, and average rating for the entire group. This makes it possible to see at a glance the earnings of this farmer in comparison with those of the group and also his relative ranking in each of the factors of management.

The farmer whose figures are presented in Figure 25 had a higher than average rating in four factors and a lower than average in four. The advantages of the high ratings are offset by the disadvantages of the low, and as a result his earnings are approximately the same as the average of the group. In Figure 26 are shown the factor ratings for a farmer who ranked low in all factors. His earnings were also quite low, as would be expected under such circumstances.

In Figure 27 are shown the factor ratings for a farmer who was above average in all factors. His earnings were higher, relatively, than his average ratings on the factors. A high rating in all factors shows a cumulative effect in increasing earnings above what one would expect from the individual ratings.

Selecting Factors for the Thermometer Chart Analysis. In selecting factors for the thermometer chart it is desirable to use only those that have a marked effect on earnings. It is also desirable that insofar as possible each of the different factors should have about the same effect on earnings. Otherwise one factor will dominate the picture and the effect of the others will be obscured. Each factor used should have an independent effect on earnings. For example, the production of butterfat per cow is

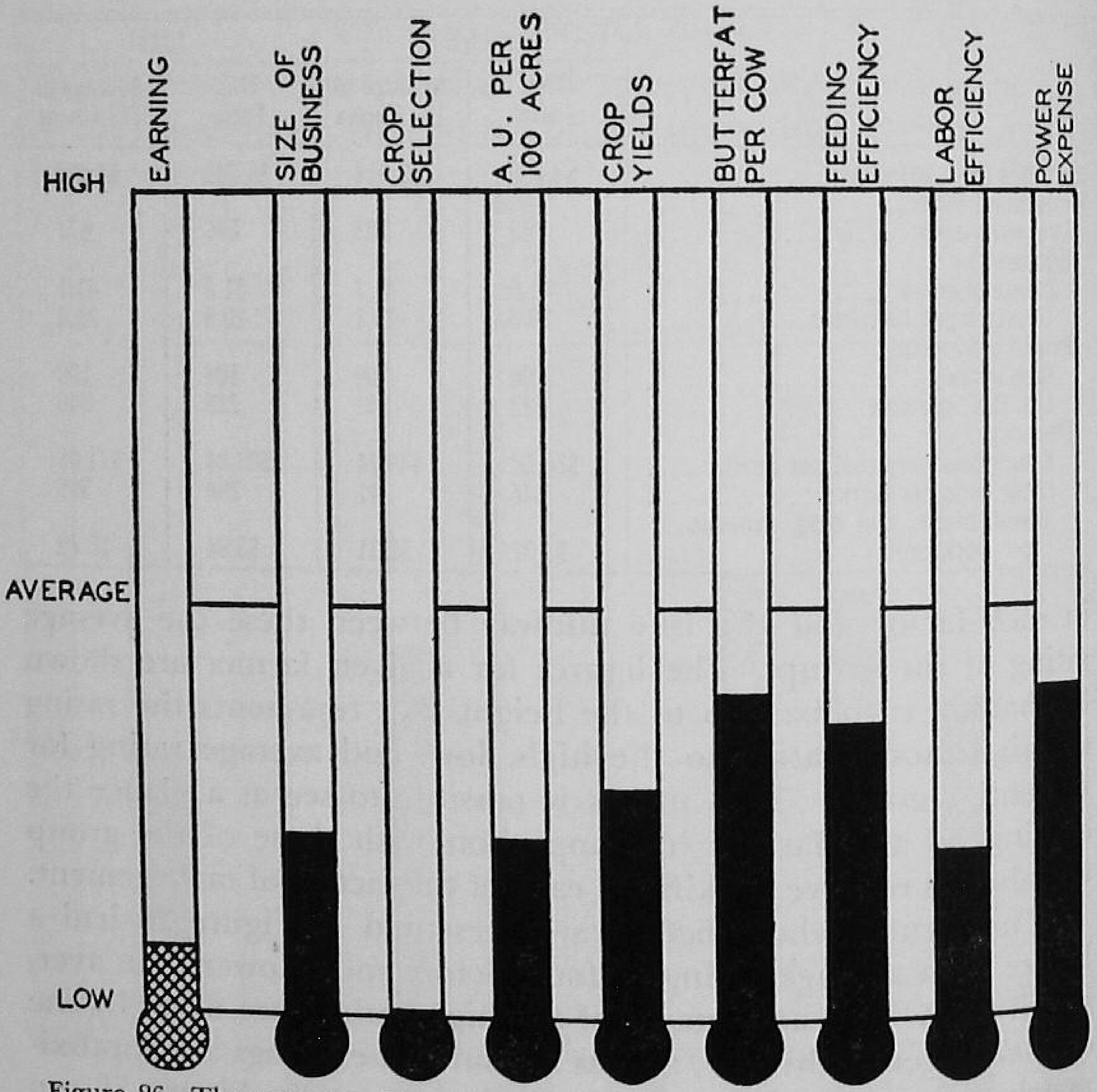

Figure 26. Thermometer Chart for a Farm with Low Earnings. Low ratings in all of the management factors are associated with low earnings.

important in determining the return over feed cost per cow. If both butterfat production and return over feed cost per cow are used as factors, the same effect is reflected in two factors. In the examples presented in this chapter, the butterfat per cow is used as one factor and the return over feed cost for all livestock other than cows is used as another. Thus duplication is avoided. Some duplication is inevitable but it should be kept to a minimum.

All factors should be applicable to all farms included in the comparison. If butterfat per cow is used as a factor and dairy cows are maintained on only a portion of the farms included, it loses its significance. In fact, the more uniform in type the farms are, the more significant will be this method of analysis.

It is highly important that the factors be simple and easily understood. Otherwise few farmers will use them or interpret

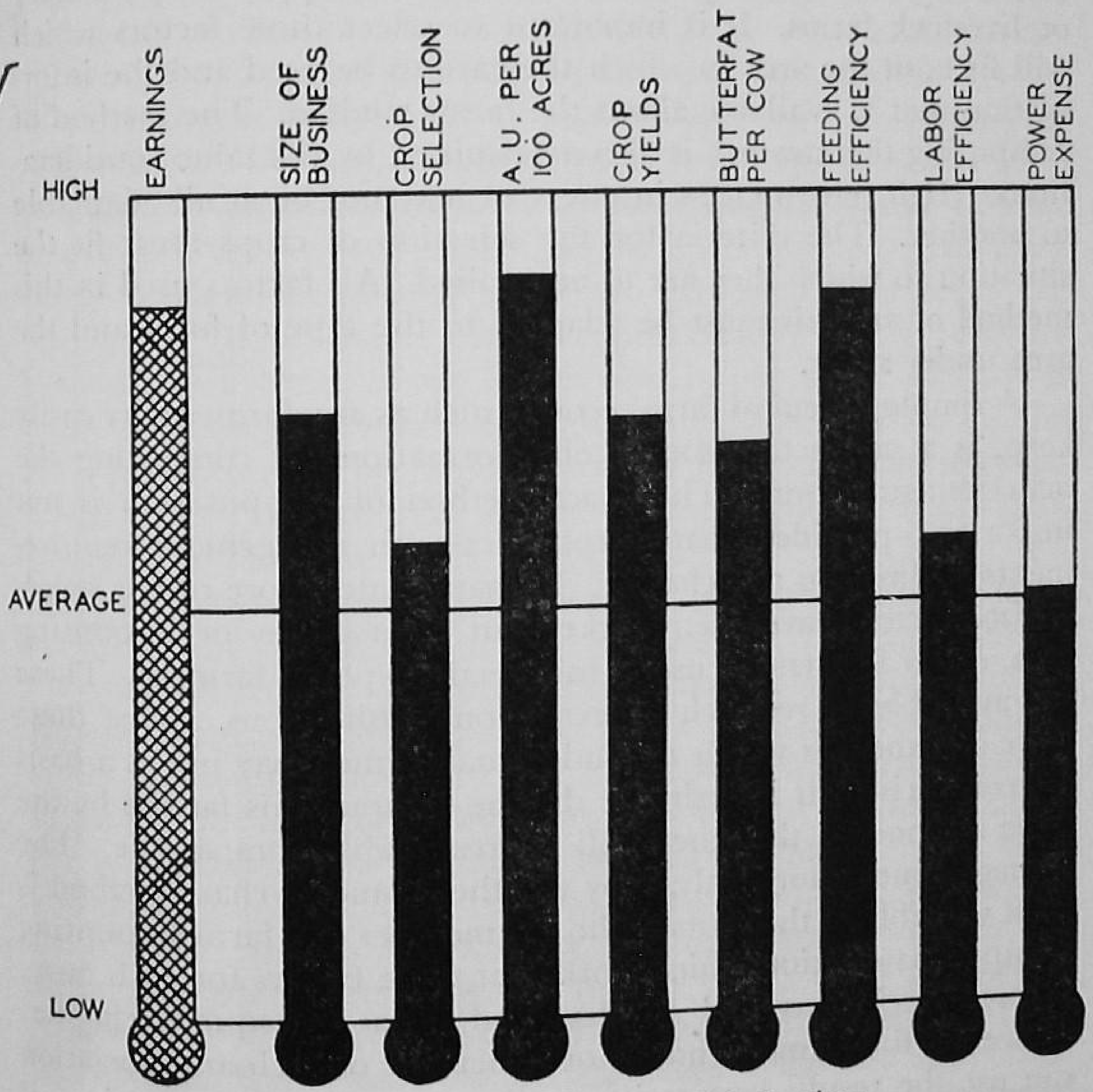

Figure 27. Thermometer Chart for a Farm with High Earnings. High ratings in all the management factors are associated with high earnings.

the results effectively. Wherever possible, it is desirable to express the factors in physical rather than monetary terms. This eliminates the varying effect of price and results in more stable measurements. To be most useful in improving the farm business the factors should be more or less within the control of the farmer so that adverse ratings may be corrected by changes in organization and operation.

The specific factors used in the examples presented in this chapter serve primarily to illustrate the use of management factors in studying the efficiency of management. It is not to be expected that these particular factors would apply to all types of farms. Some, such as size of business, index of crop yields, or labor efficiency, are of fairly general application to any area or type of farming. Others, such as butterfat production per cow or return over feed cost per unit of livestock, apply only to dairy or livestock farms. It is important to select those factors which will fit both the area in which they are to be used and the information that is available about the farms studied. The method of computing the measure is also determined by the same considerations. High return crops in one area may not be at all adaptable to another. The criteria for the selection of crops must fit the situation to which they are to be applied. All factors used in this method of analysis must be adapted to the type of farm and the area under study.

A simple system of farm records, such as any farmer may easily keep, is a satisfactory source of information for computing the management factors. The exact method of computation is not important, provided that it complies with the general requirements outlined in this chapter. In many states more or less standardized factors have been worked out from survey or accounting data, either for general use or for specific types of farming. These are available in research or extension publications. Since these serve as standards which the individual farmer may use as a basis for comparison, it is desirable that he compute his factors by the same method so that they will be reasonably comparable. The management factor analysis by the thermometer chart method is most valuable to the farmer who is a member of a farm accounting group or association which works out these factors for each farm. These associations will be discussed in a subsequent chapter. However, the farmer who is not a member of such an association can use the results very satisfactorily as a basis for comparison if he computes his factors according to the same general method.

Interpreting the Thermometer Chart. The thermometer chart and the general analysis of management factors are valuable only so far as they can be used to point out opportunities for improving the organization and operation of a farm. To know that he is low in a particular factor and that earnings suffer as a result is of no direct service to the farmer unless he can do something about it. It is seldom that the ratings on all factors, or even

all the low ratings, can be brought up to a high level. The farmer with land of relatively low natural productivity must expect relatively low crop yields. It is a permanent handicap which he can not overcome to more than a limited extent. His major attention might better be given to improving factors within his control. Earnings will be increased more by increases in the factors which are easily controlled, even though these be already high, than by increases in ratings in other factors which are now low but which can not be increased without large effort and expense.

Too often farmers are advised that the best way to increase their earnings is by bringing all factors above the average used for comparison. This may be highly desirable in some cases, but often earnings can be enhanced more by increasing the rating of some factors that are already high than by spending too much time trying to overcome natural handicaps that keep other factor ratings down. If all factors have approximately equal effect on earnings, an increase of say 50 per cent in one factor will add as much to earnings as would an addition of 10 per cent to each of five other factors. The important thing is to make the improvements where they are most effective rather than try to bring all factors up to the same level.

Care must be exercised in interpreting a thermometer chart because of the interrelations between factors. This is illustrated in Figure 28. In this case the farmer rates above average in four factors, about average in two, and below average in two. Superficially it would appear that the earnings of this farmer should be equal to the average of the group or somewhat greater. Actually they are much below average. This farmer had a fairly large business, a good selection of crops, fairly good crop yields, and fair efficiency in the use of labor and of power. However, his greater size of business was due mainly to his large number of livestock per 100 acres, and both butterfat production and the returns over feed cost from this livestock were low. Size then becomes a liability instead of an asset. The advantages of a good cropping system and good crop yields are sacrificed when these crops are fed to unprofitable livestock. This interrelation between factors must be carefully observed and appraised in interpreting a thermometer chart.

APPLYING THE FACTOR ANALYSIS TO IMPROVED MANAGEMENT

As already mentioned, the factor analysis merely points out the

weaknesses in the farm business. It can contribute to increased earnings only insofar as the farmer uses it as a basis for changes in his organization and management. The analysis may show that small size of business limits earnings. Yet some farmers are better off with a small business. They work effectively by themselves but are not able to direct the work of others to advantage. Other farmers with more capacity for management should consider how

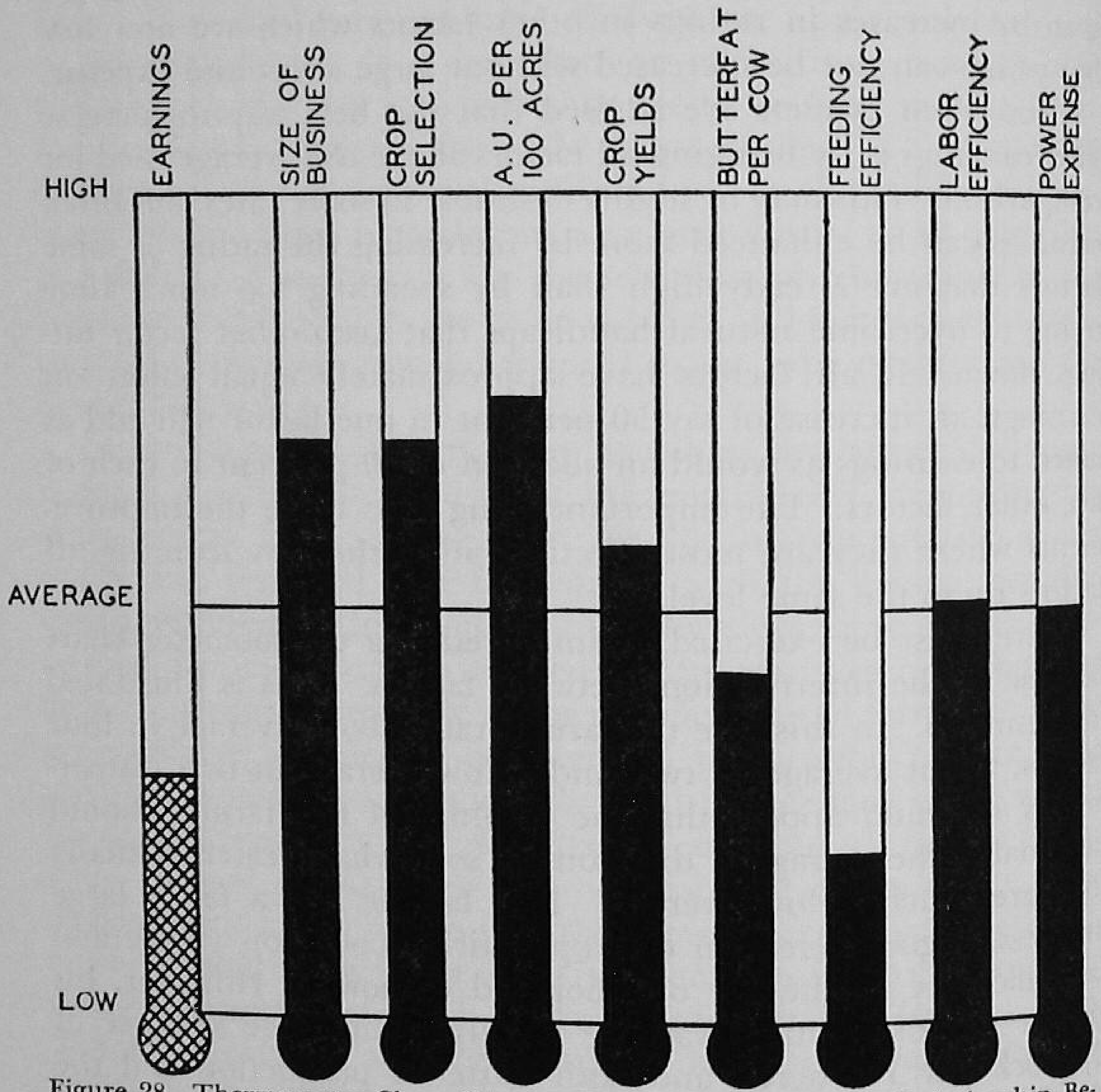

Figure 28. Thermometer Chart Showing Earnings Influenced by Relationship Between Factors as Well as by Factor Ratings.
Low dairy production and low feeding efficiency on a farm with a large number of livestock per 100 acres results in low earnings in spite of a favorable rating in the other factors.

best to increase the scale of their operations. This may be done by buying or renting more land or by shifting to more intensive crop or more intensive livestock production. The best choice depends on the opportunities available along these lines and the farmer's capabilities and preferences.

If the index of crop selection shows a low percentage of the

land in high return crops, the farmer should review his cropping system and compare it with better cropping systems of other

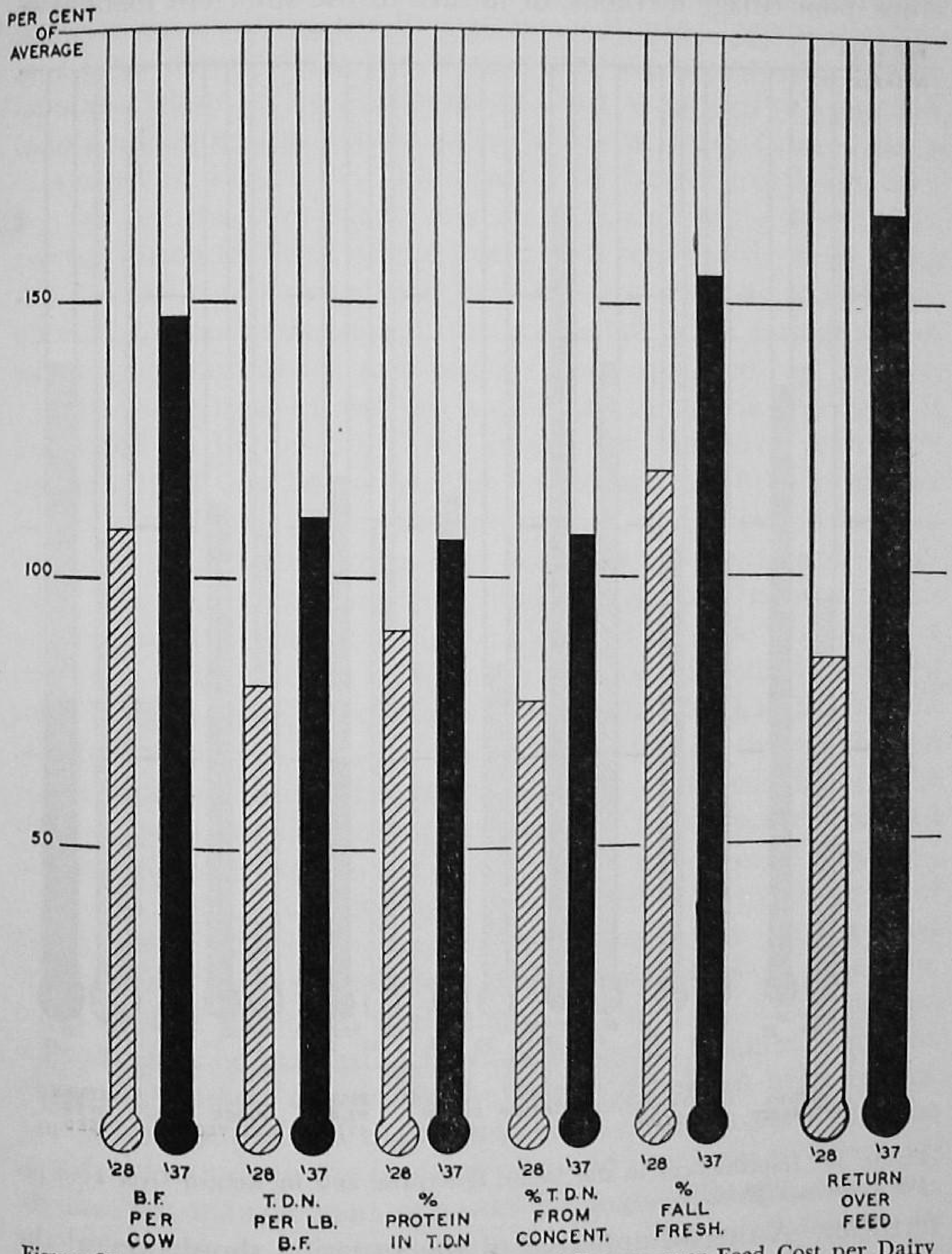

Figure 29. Improvement in Dairy Practices and Return over Feed Cost per Dairy Cow, 1928 and 1937.[1]

farmers. His low index may be due to limitations on his farm or to his failure to choose the crops that contribute most to earnings.

[1] This illustration is taken from *Bulletin 378*, Minnesota Agricultural Experiment Station, p. 21. Differences in price level between 1928 and 1937 have been eliminated by using the same prices for feed both years.

If crop yields are low, it may be due to soil of low productivity, a poor cropping system, failure to use the best adapted varieties of crops, poor tillage methods, or failure to use sufficient manure or

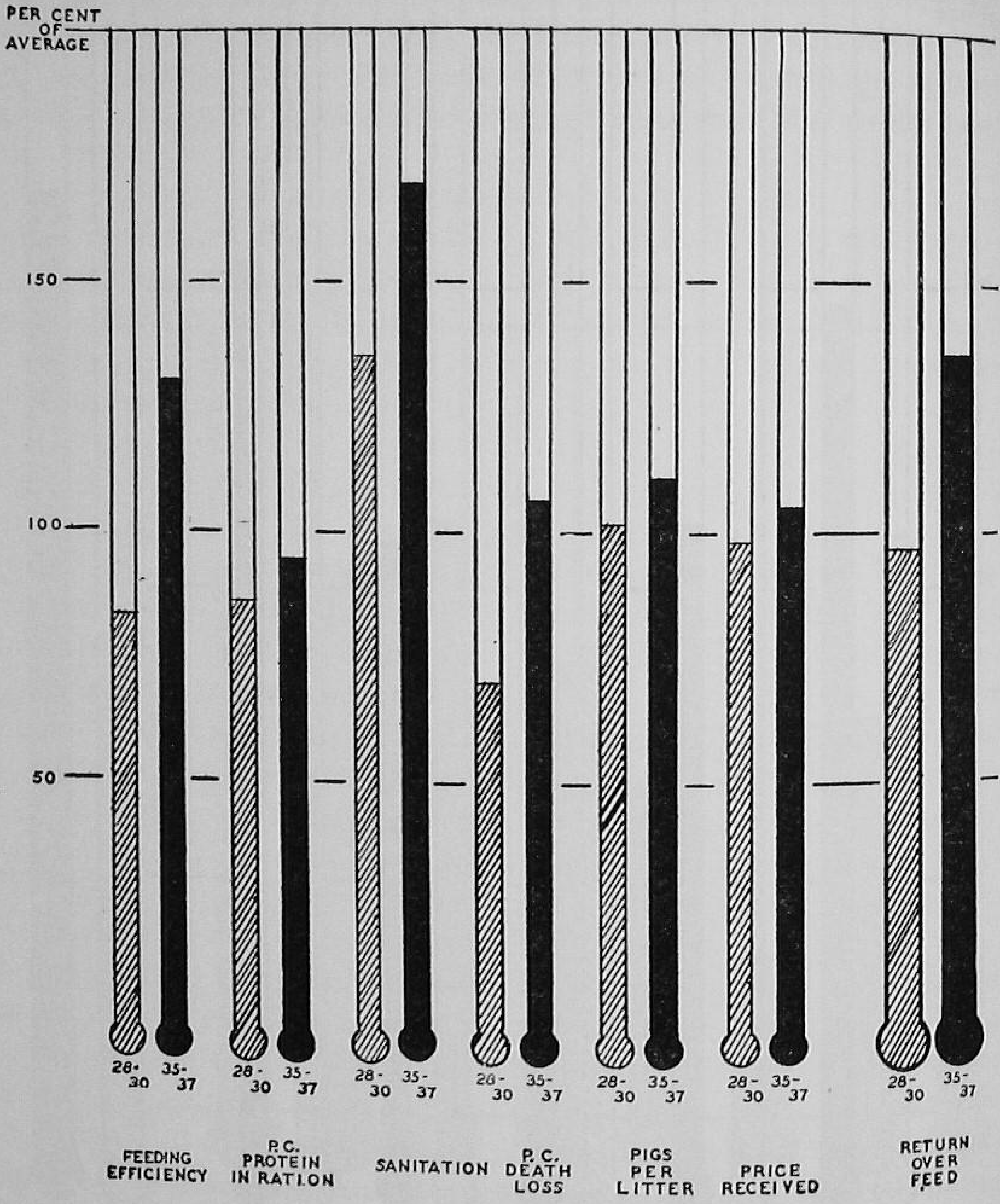

Figure 30. Improvement in the Swine Enterprise and in Return Over Feed per 100 Pounds, 1928-1937.[1]

fertilizer. A careful appraisal of the situation should reveal the most effective method of increasing crop yields.

Low livestock production or low feeding efficiency calls for a careful study of the kind of stock kept, the quality and breeding

[1] This illustration is taken from *Bulletin 379*, Minnesota Agricultural Experiment Station, p. 21. Differences in the price level among the years covered have been eliminated by computing all measures in terms of percentages of the averages of all farms in this study for each of the years covered.

of the livestock, feeding methods and rations, and the general management practices followed. Here farm records are especially valuable as a source of information. The factor analysis is also useful in determining the limitations in livestock production just as it is in determining the factors limiting the earnings of the farm as a whole. The thermometer chart as applied to a study of factors affecting the return over feed cost from dairy cows is illustrated in Figure 29. This particular farmer had lower than average returns over feed costs in 1928 and had a lower than average rating in three of the five factors considered. After using this type of comparison each year for ten years, he was able to improve his methods enough to increase all factor ratings and to secure a substantial increase in the return over feed cost per cow.

The same type of analysis applied to the swine enterprise is illustrated in Figure 30. This farmer for the three years 1928 through 1930 was below average in ratings for three of the six factors considered, about average in two, and above average in only one. His return over feed cost was below average. After using this factor analysis from year to year and improving his methods in the light of it, he was able to increase his rating in every one of the factors and also to increase his return over feed cost. In both these illustrations the farmers also had the benefit of a factor analysis of their whole farm business during the ten year period. It was this general analysis that brought out the weaknesses in the livestock phase of their farm business and led to a more detailed search for opportunities to eliminate them.

It can not be too strongly emphasized that the analysis of management factors, whether by the thermometer chart method or otherwise, merely detects the limitations and flaws in the farm business. It does not in itself eliminate them. It does, however, offer the farmer interested in improving his business a simple, systematic method of finding the factors that limit his earnings. The factor analysis and the thermometer chart, after all, must be considered as aids to the forming of sound judgment in determining the best management practices for a given farm rather than as mechanical or mathematical processes that point directly to practices and improvements needed. Farm management is far too complicated to be reduced to a simple formula that replaces study, planning, and execution.

CHAPTER XXII

THE HUMAN FACTOR IN FARM OPERATION

Most studies in the field of farm management have had for their objective an analysis of the farm organization and production operations for the purpose of discovering the factors largely responsible for the variations in the earnings of individuals operating farms in an environment offering equal opportunity to all. The methods used and the results of such analyses have been discussed in Chapters XX and XXI. Such studies have yielded much information about the sources of income and profitable operation, but they do not explain all the variations in earnings; nor have they thrown much light on the reasons for the variations in organization and operation followed in a community. Many of the variations in the farm incomes of a group of farmers operating within a limited area where physical and economic conditions are uniform are believed to be caused by differences in the personal characteristics of the farmers.

That these personal characteristics are more influential than is commonly recognized is suggested in Figure 31[1] where the factors affecting the financial returns from farming are shown in chart form. It may be noted that the factors are divided into two groups: (1) those largely controllable by the farm operator and his family and (2) those largely outside his control. Study of the diagram brings out clearly the many points in farm operation where the decision and action of the operator may vitally affect the financial returns. Farmers have long recognized the fact that *good management* is essential to satisfactory returns from farming. Few attempts have been made to break down the term *management* into its *component parts* and determine the influence or comparative weight of each part as related to income from farming. Two such studies are available, however, which give the basis for discussion of some of the more important factors.[2]

IMPORTANT POSITIVE FINDINGS

It is difficult to set up satisfactory measures of human behavior.

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1 From *Bulletin 288*, Minnesota Agricultural Experiment Station, Fig. 1, p. 4.
2 *Bulletin 288*, Minnesota Agricultural Experiment Station and *Bulletin 369*, Indiana Agricultural Experiment Station.

Since the reactions of human beings cannot be measured or weighed exactly, the results of the studies of human factors in farming must be expressed for the present, at least, in rather inexact formulae and terms. In the studies so far made some opinions commonly held have been confirmed and some have been denied. Therefore, some of the findings are positive and some are negative. Some of the positive ones will be discussed first.

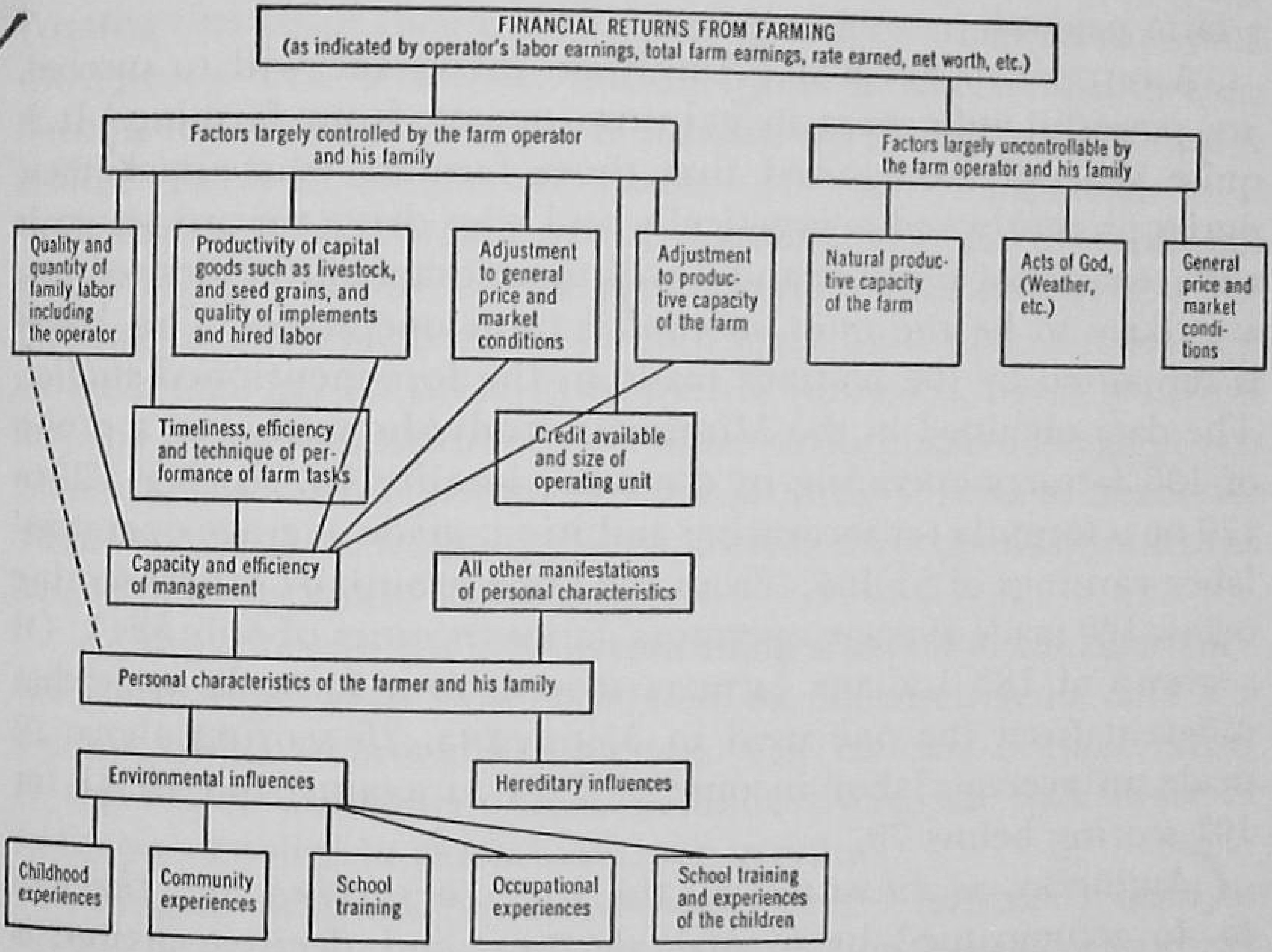

Figure 31. Factors Affecting Financial Returns from Farming.[1]

[1] *Bulletin 288,* Minnesota Agricultural Experiment Station, Fig. 1, p. 4.

WIFE'S CO-OPERATION AND INTEREST. Teamwork in the family is an important factor in making the farm business run smoothly and effectively. Where the wife helps in making the production plans or at least knows the objectives, where she participates in the buying and selling, where she assists with the farm chores, where she advises in family and community affairs and shares the responsibility in making all decisions affecting the farm and the family, the labor earnings are significantly higher than where such co-operation does not exist. In comparisons made in the Minnesota study, 17 farmers with the fullest degree of co-operation made operators' labor earnings averaging $1,757 as against only $842 for an equal number where the least degree of co-operation pre-

vailed. In the Indiana study the co-operation of the wife was also found to be of primary importance in making good incomes from farming.

These figures lend support to the thought that the wife is an important member of the planning committee on most farms. Though the male member of the partnership may do the talking and represents the farm as the manager in business affairs, the influence of a co-operative-minded wife is a vital factor in making a farm pay out.

AMBITION TO SUCCEED. Ambition, drive, the will to succeed, are powerful influences in gaining income from farming. It is quite generally recognized that those farmers who attack their duties promptly and energetically and who drive toward set goals with tenacity of purpose and a will to accomplish the desired end are likely to be the most successful farm operators. This belief is supported by the findings made in the fore-mentioned studies. The data obtained in the Minnesota study shows that in a group of 136 farmers operating in the same locality 69, scoring 120 to 179 on a formula for measuring ambition, made average operators' labor earnings of $1,464. From the same group, 67 others scoring below 120 made average operators' labor incomes of only $841. Of a group of 183 Indiana farmers scored on a formula somewhat different from the one used in Minnesota, 76 scoring above 70 made an average labor income of $991 as against only $341 for 107 scoring below 70.

Ambition, as measured by the *urge to succeed* and *the will to do* accompanied by mental alertness and decisive action, is without doubt a most important factor in gaining financial returns from farming. Getting things done quickly and at the right time is a part of good management. Ambition and the will to do are likely to be accompanied by positive action in getting the farm work done.

INTEREST IN FARMING. A liking for the work and pleasure and satisfaction in doing it are large factors in the successful prosecution of a vocation or trade. One who enjoys outdoor life and work with the soil, plants, and animals is more likely to succeed at farming than one to whom such tasks are distasteful. This is true whether it applies to specific enterprises, such as hog raising or care of dairy cows, or to the farm as a whole. As tested against specific enterprises on Indiana farms, Wilcox[1] found that 101

[1]W. W. Wilcox in *Bulletin 369*, Purdue University Agricultural Experiment Station p. 8.

farmers who raised poultry but disliked it made an average enterprise income of only $254. Another group of 82 who farmed under similar conditions but who did not dislike poultry made average enterprise incomes of $530. A group of 17 who disliked hogs made an average enterprise income of $1,011, while the balance of the group, 166, who did not dislike hogs, made average enterprise incomes of $1,586. As applied to farming as a whole, it was found that those having high scores on their liking for farming had labor incomes 107 per cent higher than those having the lowest scores. Evidently this difference in interest that farmers have in the various enterprises making up their farm business is related closely to the income made.

Technical Knowledge of Agriculture. There is an old axiom which says that *knowledge is power.* That axiom applies to farming most emphatically. From a score built upon the amount of technical agricultural information possessed by a group of farmers a test was made of the value of such knowledge. It was found that in a group of 80 Indiana farmers, 17 with scores above 70 had labor incomes 85 per cent greater than the 63 who scored below 70 in technical knowledge.

A similar test in the Minnesota study shows that the operator's labor earnings were closely related to his intelligence and the amount of his technical knowledge. The incomes of those rating in the upper one-fourth were significantly higher than those of the group scoring in the lower three-fourths.

As great progress has been made in the sciences related to agriculture and many new mechanical and technical devices have been introduced since these studies were made, it is now doubly important that those engaged in farming be well up to date on the technical information available and on modern agricultural practices.

POPULAR OPINIONS DISPROVED

In every vocation or profession certain popular opinions and beliefs become traditional from folk tales, repeated experiences, and erroneously or carelessly made observations. Some of the factors commonly thought to be associated with differences in earnings, but which are not always so associated, are next discussed.

Nationality Influences. Many people hold the opinion that the German, Danish, Scotch, American, or other racial stock contains the highest percentage of good farmers. In a Minnesota

community where Americans and Germans made up 53 per cent of the group, but which also contained Norwegian, Danish, Irish, Swedish, Czechoslovak, Scotch, French, English, and Swiss farmers, careful analysis revealed no tendency for the stock of any one nationality to excel or fall behind the others in income-earning ability. In other words, racial origin was of no significance in this group and probably is not in any group. More good farmers may be found in some races than in others, but good farmers are found in all races.

Hired vs. Children's Help. Another opinion commonly held is that farmers with large families have a decided financial advantage over those with small families or no children. This opinion is not supported by the evidence obtained in the Minnesota and Indiana studies. In Minnesota, farmers with a wife but no children made considerably higher operators' labor earnings than those having one or two children over 10 years of age, or than those having three or more children over 10 years. In fact, the children seem to be a handicap, as the group making the lowest incomes was the one having families of three or more children over 10 years of age. In the Indiana study no significant difference was found in labor income between farmers having no children and those having one to three children over or under 10 years of age.

Several reasons may be offered for this seemingly strange contradiction of popular opinion. One is that probably some of the advantages of having growing children help with the farm work are offset by the greater amount of time spent by the parents in training the children. Another reason is that children now spend more time in school and quit school at a later age than formerly. Also there is a tendency to protect the children from the heavier tasks of the farm, which may result in lower production or impaired quality of product. Shorter days of work and less effective effort often accompany the use of child labor. Even having grown sons at home who are beyond school age appears to be of no advantage in the labor income of the operator.

It is commonly supposed that the help of children in getting the farm work done is more economical than hired help. This may be true if the children are full grown and good workers, and if their time is fully employed. Where fair comparisons have been made it was found, however, that farmers using the largest amount of hired help made the largest operators' labor income. The data available indicates that men who have to hire help to do

the work they cannot do themselves may not be handicapped by that necessity.

INHERITANCE NO ADVANTAGE. The children of the pioneer settlers, following the Civil War, used to sing a little play song that ran, "Ring around the rosy, a pocket full of posey, Uncle Sam is rich enough to give us all a farm." That attitude may have been a desirable thing at the time, but there appears to be a disadvantage rather than advantage in having any other uncle give one a farm in these later days. That, again, is in disagreement with popular opinion and with the desires of many who think they would like to farm if only they had a farm. The statement is based on a comparison of earnings made by farmers who had inherited half or more of their property with earnings made by farmers who had gained their property entirely through their own effort. Those who had inherited the larger proportion of their property had minus labor earnings. That is to say, they had to live off their capital account. Those who had inherited none or less than half of their property made operators' labor earnings of plus $701, although the farms operated were of approximately equal quality.

The explanation of this unexpected result probably lies in the mental attitudes of the two groups. The men who must rely on their own efforts in acquiring a farm are driven to strive harder than the others by the force of economic necessity. Those who inherit all or a good part of the property may feel that they have arrived at their goal and so are less inclined to drive themselves to the limit. It is possible, also, that those who purchase their farms are more likely to get farms suited to their own tastes and capacity than those who take what is handed to them. It is likely, too, that some of those inheriting farms are farming only because the property was given to them and not because they like to farm. The ambition to succeed is not so strong in these as in the ones who are farming because they want to do so.

FARMERS DO NOT ALWAYS FOLLOW BEST PRACTICE

Few people live up to their full opportunities. Many have the "know how" to do better than they do, but for some reason that appeals to them, take another or an easier course. Farmers are no exception to the general run of humanity in this respect. It will be noted in any community of farmers that there are many variations in the methods employed in crop production and in caring for livestock. Certain practices in crop culture and live-

stock rearing are known to give the best results. Yet a wide variation will be found in the number of these best practices that are adopted and followed by the farmers in the community. It would seem that farmers, knowing that these best practices lead to higher income, would follow them, but the fact is that they do not always do so. It will be of interest to know why they do not.

Individuality and independence determine the decisions and actions of most farmers. While a certain farmer may know that a given practice is best suited to a community as a whole, it may not fit his particular soil, or he may lack equipment, or experience may have taught him that some deviation from the practice will give better results on his farm. He therefore is warranted in making an "operator's choice" as to which practice to adopt. He may do so knowing that the common practice for the community, if followed, would give higher returns, but feeling that he is not in a position to use it.

Following the best practices calls for planning ahead, and that is a task that many individuals fail to do. They may know of the good practices and intend to follow them, but *"just don't get around to it."* In other words, they do not make their plans in time, or do not begin in time, or for some other reason allow themselves to do less than their best. This tendency may stem from a lack of ambition. The urge or drive to do their best is lacking, and they are satisfied to take the lower returns rather than to put a higher degree of exertion into their operations.

The two factors, "operator's choice" and lack of ambition, account for most of the deviations from the best practices. However, lack of capital, uncontrollable conditions, and lack of information sometimes account for individuals failing to use them. The ability to make wise decisions and the ambition to follow the practices known to be best for production of crops and livestock are, without doubt, closely related to good incomes.

THE HOME INFLUENCE ON THE FARM BUSINESS

Only a few of the human factors influencing the income from farming have been discussed. There are many more, undoubtedly, that have as much or more influence than those that have been presented. Many of them are intangible and difficult to evaluate. The influence of the agricultural press, of extension education in agriculture, of community activities and leadership are unmeasured and often unappreciated. Many of these influences rise out of the home and family environment and desires. Non-economic

motives often prompt decisions of the farm operator. In no other industry is the home so much a part of the business as in farming. Probably no other industry is so much influenced by non-economic motives. Farmers find many satisfactions and comforts in their farm homes that can not be measured in dollar incomes. The fact remains that those who love the outdoors, who like the rural environment, who have the desire to own a farm and the ambition to possess and operate one are the persons who will best succeed at farming.

CHAPTER XXIII

SHAPING THE WORK PROGRAM

One of the big problems of the farmer is to so plan the work program that labor may be efficiently used. Labor generally ranks next to feed as a cost in livestock production. It ranks next to land and is approximately equal to power as a cost in crop production. Efficient use of such an item of cost must necessarily be an important factor in successful operation. The farmers who are able to plan their organization and the details of their work in such a way that each worker can care for a large acreage of crops and a large number of livestock tend to obtain larger earnings than those whose labor accomplishment per man is less. This tendency has already been illustrated by the data presented in Table XLII, Chapter XX.

INFLUENCE OF FARM ORGANIZATION ON LABOR EFFICIENCY

The problem of securing efficient utilization of labor must begin with the organization of the farm. A wise combination of enterprises, a good physical layout of the farm, and a well-coordinated set of machinery and equipment will contribute materially to high labor efficiency. This problem must be kept in mind from the time that the first plans for the organization are laid. Constant attention must be paid to it in order to maintain an efficient organization.

Importance of a Well-Balanced Crop and Livestock Combination. The first step in planning an organization which will effectively utilize the labor is to provide a well-balanced crop and livestock combination. The crops grown must be those which will yield a high net return. The proportion of the land used for each crop must be such that the requirement for labor will be fairly uniformly distributed through the crop season. There should be no time when there are great peaks in the labor requirement, if it is difficult to obtain additional temporary labor.

The kinds of livestock raised, like the kinds of crops grown, should be those which yield the greatest return for the farmer. The kinds and numbers should be such as will equalize the labor

PLATE XVII. AN ELABORATE FARM UNIT

A well-established and orderly farm unit should be the objective of every farm operator. To maintain good order and earn a satisfactory farm income requires a high degree of operating skill.

PLATE XVIII. MARKETING BY TRUCK

A large part of the livestock is hauled to shipping points or terminal markets by truck. The advantages are quicker delivery and less handling.

PLATE XIX. AN EXAMPLE OF PRODUCTIVE LABOR

Land is used intensively in producing sugar beets, resulting in relatively high income per acre. Labor used in growing sugar beets is, therefore, productive labor.

PLATE XX. MACHINES REPLACE MAN LABOR

Tractor power and large machines have greatly reduced the man hours required per acre for crop production. There must be full employment for the machines, however, if they are to reduce production costs.

load through the year. Work on livestock should be light when the work on crops is heavy.

Good crops on productive soil and good livestock will generally give the best returns to labor. No more work is required to seed high-yielding varieties of crops than to seed low-yielding varieties. Very little more labor and frequently less is required to raise crops on productive soil than on unproductive soil. The labor of preparing the seed bed and of seeding may be less on productive soil than on unproductive soil, although the labor of harvesting will generally be higher when the yields are high. Labor records kept by a group of farmers in Winona County, Minnesota, during the five-year period, 1935-1939, revealed a man-labor requirement of 3.4 hours per acre to prepare the seed bed and seed barley on farms where the yields were above average, as compared with 3.3 hours, or practically the same, on farms where the yields were below average. Harvesting, however, required 6.4 man hours per acre on the high-yielding farms compared with 4.8 on the low-yielding farms. But, in spite of the extra labor required for harvest, the total labor required to produce one bushel of barley was only .34 hour on the high-yielding farms compared with .45 on the low-yielding farms. [1] Similar relationships will be found to hold true for livestock.

PRODUCTIVE AND UNPRODUCTIVE LABOR. Labor used in the care of crops and livestock may be defined as productive labor. Labor used in the repair and maintenance of buildings, fences, machinery, and equipment, in cutting weeds, and in tidying up around the farm may be defined as unproductive labor. The productive labor is that which results directly in products available for sale or for feeding. It is the income-producing work of the farm. The unproductive labor is that which does not yield directly any salable products and does not add to the income. Although much of it is necessary, this work is primarily a source of expense. The farm should be so organized that as large a proportion of labor as possible can be spent in productive work.

Some unproductive work is, nevertheless, necessary on all farms. Buildings and fences are necessary for livestock production. Machinery is needed for crop production. It must be kept in repair to prevent too rapid deterioration and to avoid serious cash outlays at a later date. Weeds must be cut and ditches must be filled to maintain the productivity of the soil.

[1] Unpublished data of the Division of Agricultural Economics, University of Minnesota.

Some work, as keeping the farm neat and orderly, may be justified on the basis of the pleasure derived by the farmer and his family even though it yields no financial return. But the farmer must carefully determine whether or not this work will yield greater satisfaction than the things which could be purchased if the work were devoted to tasks increasing the income. Will this satisfaction be of more value than the additional comforts that could be purchased for the home, or the education that could be provided for the children?

WISE USE OF FAMILY LABOR. The organization of the farm must provide ample productive work for the family labor. Since no extra outlay is needed for this family labor, it is frequently used very freely, particularly on unproductive work. But, if ample productive work were available, the earnings of the farm could be increased and the standard of living raised.

Less productive work generally can be provided for family labor than for a corresponding amount of hired labor. Since part of the responsibility of the parent is to teach the children, considerable time must be spent in giving this instruction. The children must be given an opportunity to perform many tasks which are new to them; but one of the valuable lessons which must be taught is, that the successful man spends a large proportion of his time in effective application to productive tasks.

EFFICIENT FARM LAYOUTS ARE NECESSARY. The physical layout of the farm must be carefully planned in order to promote labor efficiency. Fields must be of good shape and sufficiently large to waste little time in turning or in moving from one field to another. According to labor records kept by a group of farmers in Winona County, Minnesota, the labor requirements per acre for crop operations are smaller in large fields than in small fields. The data obtained from these records are summarized in Table L. Labor requirements for harrowing and for drilling small grains were quite high for fields of less than 5 acres. They were considerably smaller for fields of 5 to 10 acres. The increase in labor efficiency was quite small for fields of more than 15 acres. In areas where larger machines are used, the most efficient size of field is probably larger than this. The fields must also be so arranged that the distance from the farmstead to the field is short.

The farmstead must be equally well planned. Placing the buildings close together, but leaving enough space for adequate fire protection, will save many steps and much time. Placing the granary near the barn and the corncrib near the hog house will

eliminate much unnecessary work in carrying feed. The machine shed should be located between the barn and the fields. Fences around the farmstead should be few, in order to save outlay for construction and labor for maintenance, and they should be so located in relation to the buildings and fields that it will rarely be necessary for the farmer to open and close gates in going about his day's work.

Each building should be planned to save time and labor. Hay and grain-storing equipment should be adapted to the building. Hay chutes and grain spouts should be located near the mangers. The milk house should be near the barn to provide quick access to the milking equipment. The numerous available bulletins and books on farm construction will provide many other suggestions for labor-saving plans and devices for the farm buildings.

TABLE L—MAN HOURS REQUIRED PER ACRE FOR HARROWING AND DRILLING SMALL GRAIN WITH HORSES ON FIELDS OF VARIOUS SIZES[1]

Size of Field	Man Hours Per Acre	
	Harrowing	Drilling Small Grain
0.0 to 4.9 acres	.46	.93
5.0 to 9.9 acres	.36	.71
10.0 to 14.9 acres	.31	.62
15.0 to 19.9 acres	.27	.60
20.0 to 24.9 acres	.27	.62
25.0 acres or more	.24	.57

The power and machinery should be adapted to the farm and to the labor supply. The type and size of the machinery should be adapted to the source of power. Insofar as possible tractor machinery should be used with the tractor. Power and labor are frequently wasted when horse equipment is used with the tractor. The large amount of machinery which is used on a modern farm seriously complicates the problem of co-ordinating machines and power. Many machines must be used after improvements have been made on others. Many farmers are still using machinery designed for the standard narrow-tread tractor after they have purchased a general-purpose row-crop tractor. Careful thought and planning for future years will help them to select the machinery which is best adapted to their situations.

SIZE OF FARM AFFECTS LABOR EFFICIENCY. The size of the

[1] Winona County, Minnesota, 1935-1936.
(Unpublished data of the Division of Agricultural Economics, University of Minnesota.)

farm is one of the important factors influencing efficiency in the use of labor. The size of fields can be large on large farms, and large labor-saving machines can be used. For many tasks in the care of livestock, little more time is required for a large herd than for a few head. Labor accomplishments tend to be higher on large than on small farms. Among the southeast Minnesota dairy farmers that have been referred to several times previously, the labor accomplishment per man was only 88 per cent of the average on farms of less than 140 acres, but was 111 per cent on farms of 240 acres or more.

The size of the farm, however, can not be increased indefinitely in the effort to increase the efficiency of labor utilization. After a moderate-sized farm has been provided, the labor saved by a further increase in size will be quite small. Although labor efficiency can be increased by the use of large machines, the increase will be small if the farm becomes so large that a second machine must be added. Problems of supervision are also increased with the increase in size of the farm. This problem is very serious for many farmers. Many men are able to plan their own work very effectively, but can not plan work for others. Some men are unable to judge and select capable hired men and to handle them in such a manner as to obtain the most productive work.

INFLUENCE OF WELL-PLANNED OPERATION ON LABOR EFFICIENCY

Good management of labor must accompany a good organization in order to achieve high labor efficiency. All tasks planned must be completed. Tasks which are of a seasonal nature must be performed at the time which is most favorable. The tasks which will be performed each day must be those which are most important. The worker assigned to each task must be the one who can perform the task most economically.

THE CALENDAR OF WORK. The work must be planned for a considerable time into the future in order that time may be available for each task and that power and equipment may be provided for each worker when he needs them. Although many farmers are able to carry in their minds the large number of details which are involved in the operation of a farm, most men must use some supplementary aid in their planning. A carefully prepared calendar of operations will help the farmer to anticipate the tasks which lie ahead and plan for their performance. A brief calendar

TABLE LI—CALENDAR OF WORK[1]

Task to Be Performed	Approximate Starting Date	Approximate Man Hours Required											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
SMALL GRAINS:													
Clean seed	March			55									
Springtoothing	Apr. 10				12								
Harrowing	Apr. 10				52								
Seeding	Apr. 14				39								
Cutting and shocking	July 20							300					
Threshing	Aug. 5								210				
CORN:													
Spring plowing	May 5					30							
Harrowing	May 10					40							
Planting	May 15					22							
Rotary hoeing	May 30					16							
Cultivating	June 5						88	25					
Cutting	Sept. 1									42			
Filling silo	Sept. 4									120			
Shocking	Sept. 20									82			
Shredding	Oct. 10										200		
HAY:													
Phalaris—1st cutting	June 10						42						
2nd cutting	Sept. 1									33			
Alfalfa } —1st cutting	June 15						90	14					
Timothy } —2nd cutting	Aug. 20								68				
MISCELLANEOUS CROP WORK:													
Planting potatoes	May 25					20							
Digging potatoes	Sept. 25									32	60	78	
Fall plowing	Aug. 25								28		70		
Manure hauling		41		18	102	22							
Total crops		41		73	205	150	220	339	306	309	330	78	
Work on wood	Fall & winter											120	120
Rebuilding fence west side of field 4	May					50							
Repair fence, especially around field 10	Aug.								30				
Repair hayloft	June						100						
Prepare building for winter	Nov.											100	
Repair harness and machinery	Feb. & March		40	60									
Livestock		500	540	600	510	470	420	460	370	380	380	400	480
TOTAL LABOR REQUIRED		540	580	733	715	670	740	799	706	689	710	698	600

[1]Southeast Minnesota Dairy Farm.

of work for the southeast Minnesota dairy farmer is presented in Table LI. Only the major tasks are listed. The data for this calendar were obtained from the farmer's records. There are several other forms of calendars that could be used.

The first step in the preparation of a calendar of work is to make a list of all the tasks to be performed. These should be grouped according to the enterprises to which they pertain. For example, the tasks involved in the production of corn may be plowing, disking or springtoothing, harrowing, planting, cultivating, and harvesting. This list will vary among the farmers according to the crops grown and the type of soil and equipment available. Particular care should be taken to list all tasks which do not constitute part of the day-to-day chore work.

After preparing the list of tasks, the next step is to determine the time when each must be performed. The experience of the farmer will generally provide the information which is needed. Records kept by him will help to make these dates more definite. Many farmers keep records of the dates when they begin their principal oprations, as their grain seeding. Data obtained from research work and published by experiment stations and information given by neighbors will provide valuable help to the inexperienced farmer.

The experienced farmer will know the approximate amount of labor which will be needed for each enterprise and will know the periods when the different tasks will conflict for labor. The inexperienced farmer or the farmer reorganizing his business must estimate the time required for each task. Here, too, the experiences of the farmer and the information gained from neighbors will provide much of the necessary data. Many experiment stations have issued publications giving the average labor requirements for various tasks. The length of time required each month on the Southeast Minnesota Dairy Farm is shown in Table LI. Variations in the labor required for the regular chore work should be carefully noted.

The calendar of work will indicate the times of year when there is likely to be an extremely heavy demand for labor. The work on the Southeast Minnesota Dairy Farm seems to be fairly well distributed. A slightly larger proportion of this work could have been planned for June, July, and August when the children are not in school. The general repair work has been planned for the months when crop work is light. For example, the fence on the west side of field No. 4 had to be repaired before the cows

could be turned out. This work was done in May, when crop work is heavy. It should have been done the previous fall.

The calendar of work will also serve as a valuable reminder of tasks to be done. Each task should be checked off when it is completed. New ones which arise should be added.

EFFECT OF THE WAGE LEVEL. The tasks which will be completed during the year and the thoroughness with which they will be performed will depend partially upon the wage level. When wages are high, some tasks may be omitted and others may be done less thoroughly in order to save time. Slightly lower yields may be accepted in order to reduce the labor costs. Much of the work of repairing of fences and of buildings, cutting of weeds, and other maintenance work may be omitted or postponed. The farmer must determine whether the extra work done will yield a return sufficiently high to pay for the extra labor cost.

ASSIGN EACH WORKER TO THE RIGHT JOB. The farm manager can well spend time in studying the abilities and preferences of each worker. Each man can then be assigned to the task for which he is best fitted. For example, the man who is most proficient at handling a tractor should do most of the work involving the use of the tractor, while the man whose interest lies in horses should be assigned to the work which utilizes the horses. Each man will then do the job in which he is most efficient. By doing this type of work throughout the year, he can acquire the skill which will increase his efficiency.

On farms where a large amount of family labor is available, this type of assignment of tasks will not be as well adapted. In order that the children may learn the problems of farming as thoroughly as possible, each one must be allowed to perform a variety of tasks even though he may not be as efficient at some work as some of the other children. The training will probably be more thorough, however, if they are allowed to remain at each task sufficiently long to acquire some skill.

PLANNING THE DETAILS OF THE DAY'S WORK. The calendar of work will provide a general guide as to the tasks that are to be performed during the year, but the work for each individual day must be planned in considerably greater detail than is provided by this calendar of work. The tasks to be performed during the day must be arranged in the order which will give the least waste of motion. Jobs of a like nature should, insofar as possible, be performed at the same time of the day. For example, if one day a certain worker is to haul out a load of manure from the barn,

finish planting the corn, repair a fence, and hoe the garden, the jobs requiring the use of the horses should be done in succession in order that time will not be wasted in hitching and unhitching the horses.

(The successful farm manager will plan his work far enough ahead so that all arrangements are made for each task when the time comes.) For example, if the job for a particular day is to spray the potatoes, the spray materials should be on hand and the sprayer should be in condition by that day. If the farmer has planned ahead, he will have purchased the spray materials while in town on some other errand and the equipment will have been repaired, oiled, and adjusted on some rainy day. Many farmers waste much time going to town on errands that could have been avoided had they been more foresighted.

(The farm manager must plan alternative tasks for each day.) If he had planned to work in the fields on a certain day, a shower might upset those plans and require the assignment of different tasks. A notebook carried in the pocket or a sheet tacked in the barn may be used to keep a record of tasks that are to be performed on rainy days. Tags attached to the machines at the time they are stored, indicating repairs that must be made, will also be helpful to provide suggestions for work on rainy days.

(Labor efficiency may also be increased greatly by utilizing short periods of time that are easily wasted.) A few minutes between the time that one task is completed and the time to quit work for noon or for the evening may be profitably spent in doing some of the many small jobs around the farm. For example, one farmer completed the work of repairing his fences at about 11:30 in the forenoon. Since he was planning to cultivate corn in the afternoon, he harnessed the horses and greased the corn cultivator during the time that he was waiting for dinner. He was then ready to put in a full afternoon's work in the cornfield.

(Timeliness of work is frequently a factor increasing the efficiency of labor.) If the corn is cultivated at the proper time when the weeds are just breaking through the ground, when most of the weed seeds have germinated and the plants are too weak to withstand the disturbance of the cultivator, fewer cultivations may be necessary.

THE HUMAN ELEMENT IN LABOR MANAGEMENT. (The wise farm manager realizes that after all the problem of labor efficiency is to a large extent a human problem. Even though the farm is well organized and the work is well planned, labor accomplish-

ments will not be high unless each worker exerts himself in order to work as rapidly as possible. Each worker's full attention must be applied to the task at hand.

Each worker on the farm should be encouraged to take an interest in his work. Although the workers should be reprimanded for careless work or should be corrected on work which is not properly done, they should also be commended for work which is well done. A worker will generally take a greater interest in the work and work more efficiently if he carries some of the responsibility for the performance of the task. This responsibility can, of course, be assigned to him only insofar as he has demonstrated his ability to carry it.

The farmer must always be alert to find new ways of improving his efficiency. He must observe the methods that are used by other farmers. He must be particularly careful not to assume that the methods which he carefully planned a number of years ago can not be improved today.

CHAPTER XXIV

FARM WORK SIMPLIFICATION

The importance of high labor efficiency has been discussed in previous chapters. Some of the factors contributing to this high efficiency have also been discussed. Research is showing that a systematic study of the jobs to be done on the farm and the methods of doing them can materially increase the work accomplishment per worker. On many farms changes can be made that will reduce the cash outlay for labor. On other farms higher labor efficiency may permit a higher income by increasing the volume of business or improving the quality of work done. On most farms it may make possible more leisure time and less physical fatigue.

The work accomplishments per worker can be substantially increased by systematic search for simpler ways of doing the work. The objective of this search is to reduce the complexity and the effort involved in the job. The simpler, easier ways of doing the job will usually reduce the time required as well. The work accomplishment per worker can be increased by higher speed of work and more hours of work per day, but this will usually increase fatigue, decrease quality of work, and reduce the opportunity of the worker to participate in other activities.

Observations of farmers and research workers show that work can be simplified. There is a large variation among farmers in the time and effort required to accomplish a given amount of work. Some farmers are able to do a task faster and easier than others. Research is showing that the farmers who require a large amount of time and effort can reduce this expenditure. On one north-central farm the time required per day for the regular dairy chores on a 13-cow herd of cattle was reduced from three hours and 39 minutes to two hours and 45 minutes per day. Adjusting for seasonal variations in work, this represents a saving of 300 hours per year or one month of time for one man. This saving was made without any reduction in the quality of work.

TIME AND EFFORT USED TO COMPLETE A TASK

(Simpler, easier, faster ways of performing farm tasks can be achieved by (1) Simplifying body motions, (2) providing con-

venient farm and building layouts and effective equipment, and (3) modifying the job to be done.)

SIMPLIFYING BODY MOTIONS. Most of the farmer's work day is filled with manual work. Effective use of the body can reduce effort and save time. Increased skill will reduce the amount of wasted time. This skill can be partially increased by practice. Some of it is determined by muscular co-ordination, which may differ widely between workers.

Good posture while working will reduce fatigue. Standing or sitting in such a way as to balance the weight of the body reduces the muscular effort required. Sitting at a job usually is less tiring than standing. Occasional change from a sitting to a standing position will prevent unnecessary fatigue. In heavy jobs, such as lifting or pitching, use of the powerful leg muscles rather than those of the arms or back will permit continued work and reduce the danger of physical injury.

Using both hands for effective work will increase output while permitting the worker to move more slowly. A study of tomato picking in Indiana showed that workers who picked with one hand, leaving the other hand idle or using it to transfer tomatoes to the hamper, spent 3.1 minutes to fill a hamper. When the same workers used both hands for picking, they spent only 2.5 minutes per hamper. This saving was made by using two hands and not by increasing the speed of motion. There are many operations on the farm for which two hands can be used simultaneously to good advantage. Included in these jobs are picking potatoes, berries, and fruits, snapping sweet corn, and crating eggs.

Time and effort can be saved by eliminating unnecessary travel. In going from one task to another the worker should walk by the most direct route. Planning work ahead may make it possible to eliminate unnecessary trips. Reduced travel may also refer to travel by parts of the body, e.g., the hands. Some workers throw an ear of corn with a full arm movement. Others use a simpler and shorter wrist and forearm movement.

PROVIDING CONVENIENT FARM AND BUILDING LAYOUTS AND EFFECTIVE EQUIPMENT. Buildings and equipment can frequently be designed so that gravity or other power sources can do the work often done by human power. When feed is stored above livestock, gravity can be used to deliver the feed, eliminating the necessity of carrying. Elevators can frequently be used in place of the shovel to move feed and supplies.

Convenient arrangements reduce travel. Since a large part

of the farmer's day is spent in travel, this is an important consideration. Field layout can frequently be modified to reduce the distance required to travel from the farmstead to the field or from one field to another. Farm buildings should be located as close together as is consistent with fire risk and other factors. Feeds and supplies should be stored as near as possible to the place where they will be needed. Within buildings different work areas should be located as close together as possible, with doors and alleys so arranged as to permit travel by the most direct route. Equipment requiring manual control should have all controls close together to reduce the amount of hand travel.

Travel can also be reduced by moving larger loads with fewer trips. This can be done with push-carts or with power equipment. Passageways should be wide, travel surfaces should be smooth, and slopes gentle, especially if human power is used to move these carts.

Gates, doors, and other obstructions cause many delays. Loads may have to be shifted from one hand to another or may have to be put down and picked up again while passing through gates or doors.

Modifying the Job To Be Done. Many workers spend some time at jobs which have no effect on the final product. There may have been a reason for these jobs in the past, but the reason may have disappeared and the job is continued through habit. Other jobs do give some return, but the return may be too small to justify the time that is spent. These can be effectively eliminated.

Changes in crop and livestock practices may permit a saving in time and effort without materially affecting the production. In some cases the form in which the product is marketed can be changed; for example, fruit may be sold in bulk or it may be graded and packed in containers suitable for delivery to the consumer. In other cases a change in the proportion of the various kinds of crop or livestock or a change to a different kind of a crop or type of livestock may make material changes in time and effort required for farm work.

COMPARISON OF THE THREE METHODS

These three methods for achieving work simplification differ in the complexity of analysis and decisions that are involved. When body motions are simplified, the saving in time and effort is balanced only against the time and effort that is involved in

planning the changes. In that case the jobs that will be performed and the equipment that is used will remain unchanged. Whenever the farm or building layouts are rearranged or equipment is changed, additional costs may be incurred. These costs must be balanced against the saving in time and effort that is made. When the job that is performed is changed, the income may also be affected. This change in income, together with changes in costs that may be involved, must be balanced against the saving in time and effort. These changes in income and other costs may frequently be so large that the saving in labor becomes a minor consideration.

METHODS FOR DEVELOPING SIMPLIFIED PROCEDURES

The individual farm manager must select those working procedures which will be simplest for his farm. He may (1) adopt specific methods of working that have been developed by others, (2) improve his efficiency by comparing working methods with principles of efficient work that have been developed through study of other farms, or (3) analyze in detail each job on his farm and plan improved procedures. In the following discussion of these three methods only changes pertaining to body movements, layout of fields and buildings, more effective equipment, and simple changes in the jobs to be done will be covered. Major changes in practices and enterprises where labor will be a minor factor in the decision are discussed in other chapters.

SPECIFIC METHODS FOR DOING A JOB

For some farm jobs conditions of work are sufficiently uniform so that the same methods may be used by a large number of farmers. Husking corn, shocking grain, picking potatoes or fruit, and milking cows are examples of these operations. If such jobs have been performed in the community for a considerable period of time, the experience of a large number of farmers has encouraged the development of fairly efficient methods. Individual farmers, however, may have developed even superior methods. Watching the methods on these farms and copying those methods may permit an increase in efficiency of labor. Research in work methods is developing many possibilities for improvement. Specific information on these methods may be obtained from the various experiment stations. In all cases where specific methods are copied it is important that every detail be studied and dupli-

cated carefully or minor variations may cause a loss in efficiency.

A simplified procedure for picking tomatoes, developed by the Indiana Experiment Station, will serve as an example of these specific methods of doing work. In developing this method experienced, efficient workers were observed, timed, and their work recorded in motion pictures. These records were then analyzed to determine the easier methods of working. Comparative accomplishments with the different methods were measured.

FOUR SIMPLE RULES FOR MAKING MOVEMENTS COUNT IN PICKING TOMATOES[1]

Rule I. Use a Handle on the Hamper

1. Use a wire handle with a comfortable handpiece. The wire should be stiff, about one-fifth inch in diameter.
2. Move the hamper forward with an easy movement of one hand.
3. Carry the hamper to the road, keeping the arm and back straight. Lift with the strong leg muscles.
4. *Don't* move the hamper by gripping the edge of it with the fingers. It's much easier to grasp and move forward with a handle.
5. *Don't* carry the hamper to the road with the arms bent and the hamper held out in front of you.

Rule II. Pick with Both Hands

1. Pick with both hands close together, standing with the knees slightly bent.
2. Or pick with both hands close together and squat.
3. *Don't* pick with your hands far apart. When they are separated, you can't see what both are doing.
4. *Don't* pick with one hand while the other only holds the hamper. If you do this, you can pick only 83 hampers in the time in which you should pick 100.
5. *Don't* let one elbow rest on your knee while the hand only holds tomatoes. If you do this, you can pick only 86 hampers in the time in which you should pick 100.

Rule III. Pick as Many Tomatoes as Possible in Each Hand Before Moving the Hands to the Hamper

1. First, pick one tomato in each hand.
2. Then shift the tomatoes back into the palms of the hands.
3. Then pick a second tomato in each hand.
4. And then move the full hands to the hamper.
5. *Don't* move the hands to the hamper with only one tomato in each hand. If you do this, you can pick only 90 hampers in the time in which you should pick 100.

Rule IV. Pick Two Rows Across the Field and Keep the Hamper in Front of You

1. Set the hamper in front of you between two rows. Keep it within easy reach.
2. *Don't* set the hamper so far ahead that you have to stretch your body or throw the tomatoes.
3. *Don't* get in front of the hamper so that you have to turn your body.

COMPARING WORKING METHODS WITH PRINCIPLES OF EFFICIENT WORK. Conditions of work and ability of workers may frequently differ from farm to farm. These variations may make necessary

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[1] *Leaflet 258*, Indiana Agricultural Experiment Station.

a difference in working methods. Each farmer must then improve his own methods. Study of experienced workers is showing many principles of efficient work for the different jobs to be performed. The individual farmer may check his own work against these principles. Some of this information has been published by experiment stations in the form of check lists. These are available to farmers.

An example of such a check list is given below. These principles were derived from a detailed study of many workers operating under varying conditions.

CHECK LIST FOR POTATO PICKERS [1]

I. Container
   1. Is container adapted to your needs?
      The high hamper which is used in some sections of the United States requires too much hand travel, overturns easily, is heavy, hard to move, and hard to empty.
      The wire basket is low to the ground, is easier to move and to empty, and is therefore faster than the hamper.
      The picking belt allows you to pick directly into the sack with short movements of the hands and arms. The job of emptying is eliminated. Pickers report that it is 20 to 30 per cent faster than baskets.
   2. Is container always kept within easy reach? This is automatically done with the use of the picking belt. Baskets are usually placed in front and slightly to one side of the picker.
   3. Is mouth of the picking sack close to the ground? This reduces amount of hand travel.
   4. Is mouth of picking sack kept open? Placing picking hooks about 4 inches from top of sack tends to keep sack open. A potato suspended from the mouth of the sack by a piece of heavy wire or screw-hook saves a great deal of fumbling, especially in windy weather.

II. Picking (The following questions apply regardless of the type of picking-container used.)
   1. Do you use both hands for picking? Both hands should be used equally. A loafing hand slows up the other hand. Do you waste time by picking up a potato with one hand and carrying it to the container with another? Can you move the basket with one hand while shaking vines with the other?
   2. Do you keep hands close together so they both may be seen at the same time? If used far apart, the eyes follow one and then the other —result: fewer potatoes picked.
   3. Do you fill both hands before emptying? Take as many potatoes as possible in each hand, then scoop as many more as you can between them. The biggest loads and the shortest trips add up to the most potatoes, other things being equal.
   4. Where possible, do you empty hands as a part of move to next handful?
   5. Are you using back muscles where arm muscles could do the work, or arms where the hands could do it? Whenever possible, use a wrist motion instead of an arm motion.

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[1] *Miscellaneous Series Paper 247*, Colorado Agricultural Experiment Station.

III. Disposing of Potatoes

1. Are sacks readily available? Poor distribution of sacks wastes time. Extra sacks may be carried on hooks attached to back of belt. Don't carry too many.
2. Does a partner help you empty your basket? If partners are equally fast, this saves time; if one is slow, it wastes time for the faster picker.
3. Do you waste time by unnecessarily shaking or twisting the filled sack? Do only what is necessary to meet the requirements of the loaders.

Improvements

1. Are you constantly checking to see that you consistently do the things which will enable you to pick more potatoes more easily?
2. Are you satisfied, or are you always searching for easier ways of picking more sacks of potatoes per day?
3. Please send your suggestions on how to pick potatoes faster and easier to the Colorado Agricultural Experiment Station, Farm Work Simplification Laboratory.

DETAILED ANALYSIS OF INDIVIDUAL JOBS. A systematic detailed analysis of an individual job will reveal many possibilities for improvements in work methods. This permits adapting the working methods to the conditions and abilities of workers on the individual farms. Most methods, even though used for a long period, are subject to some improvement. Constant study is necessary in order to maintain a high level of working efficiency.

Industry has developed definite procedures for studying job methods. These procedures have been used in a large number of plants and have been found to be very effective. Experience is showing that the procedures also apply to agriculture. Although very effective, they do not represent a radically new methodology, but rather a systematic application of reasoning that has been used in a haphazard manner by most farmers. This technique of job methods analysis or process analysis involves four steps. These are:

1. List all details of the jobs.
2. Question each detail of the job.
3. Develop an improved method.
4. Use the improved method.

1. LIST ALL DETAILS OF THE JOB. Study in detail each job now being done and list all of the operations performed. This listing will be most valuable if it is written. The number of operations required, even on a relatively simple job, is surprisingly large. Unless these are recorded in written form, a large number of operations will be overlooked in the analysis.

This list may be recorded first in terms of broad groups of operations. Then, as the analysis proceeds, the individual groups may be broken down in greater detail. It may sometimes seem

that some of the details are too small to have any significance, but even large jobs are made up of a large number of small operations. Although the individual savings may be small, the possibilities for savings are so numerous that the total saving may be large.

The task of feeding ground grain and a high-protein supplement to 19 cows will illustrate the listing of the details of a job. The cows were stanchioned in two rows, facing out, with 10 cows in one row and 9 in the other. The door leading to the granary was located at the end of the litter alley, with cross walks leading to the feed alleys. The granary was located 80 feet from the barn. This job required 6½ minutes and 800 feet of travel for each of the two daily feedings. The details of the job of feeding were:

1. Go to feed alley at cow No. 1.
2. Get basket (1½ bushel capacity).
3. Go to granary.
4. Fill basket with shovel.
5. Go to barn, to cow No. 1, with full basket.
6. Feed cows Nos. 1 through 10, carrying basket in one hand and using grain scoop with other.
7. Go to granary.
8. Fill basket with shovel.
9. Go to barn, to cow No. 11, with full basket.
10. Feed cows Nos. 11 through 19.
11. Go to feed alley at cow No. 1.
12. Set down basket.
13. Fill pail with high-protein feed from sack.
14. Pick up pail.
15. Feed cows Nos. 1 through 10.
16. Go back past cow No. 1 and across to cow No. 11.
17. Feed cows Nos. 11 through 19.
18. Go to feed alley at No. 1.
19. Set down pail.
20. Go to other work.

All of these operations were repeated for the second feeding.

2. Question All Details of the Job. A systematic questioning of each detail of the job will reveal many opportunities for improvement. The following series of questions have been found effective for this purpose. Each question should be asked of all details of the job.

a. *What* is the purpose of this operation? *Why* is it done? An accurate knowledge of the purpose of the operation is needed in order to plan improvement in methods. This

analysis of the purpose may reveal some operations which are not necessary. For others it may reveal possible changes in methods of doing the work. These two questions provide two ways of seeking the same information. They should be used at the same time.

b. *Where* should the job be done? Performing the job in a different place may make it possible to do the work in a more convenient manner. Supplies may be more readily available. The product may be disposed of more easily.

c. *When* should the job be done? Some tasks may be performed at different times of the day. Operations that are performed in a series may be performed in different orders. Changing the time when the job is done may save considerable time in going from one job to another.

d. *Who* should do the job? On many farms several workers are available. One worker may be more efficient at a given job than others. Assigning the job to a different worker may save time.

e. *How* should the job be done? There are many ways in which various jobs can be performed. Body movements can be changed, the work area may be rearranged, or new equipment may be provided.

These questions will be used most effectively if the first is applied to each step in the job, then the second is applied, and so on. As one question is being analyzed, ideas that will help answer other questions may occur. These should be recorded for later use. A detailed analysis of these ideas at the time may represent wasted effort if continued analysis of the first questions reveals opportunities to eliminate the job.

The use of these questions is illustrated by application to the list of details of feeding grain.

a. *What* is the purpose of this operation? *Why* is it done?

Step 1. Go to feed alley at cow No. 1. The primary purpose was to get to the basket. Walking to it was necessary only because the previous job ended some distance away from the basket. This trip could be eliminated if the previous job were rearranged to end at the basket or if the basket were left where the previous job ends. Consider this possibility under "Where should the job be done?"

2. Get basket. Since the farmer does not use this basket continuously, it seems necessary to get it each time it is used.

3. Go to granary. It is necessary to get to the feed supply.

It might be possible, however, to bring the grain at some other time when it would otherwise be necessary to walk empty-handed from the granary to the barn. Although it may not be possible to eliminate the trip to the grain bin, it may be possible to reduce the length of the trip by storing the grain in the barn.

4. Fill basket with shovel. Since a considerable quantity of grain is ground at one time, it is necessary to fill the basket each time.
5. Go to barn, to cow No. 1, with full basket. The primary purpose of the entire job is to get the feed to the cows. This job can not be eliminated. But it may be possible to reduce the distance the grain is carried.
6. Feed cows Nos. 1 through 10. This is part of the basic job of getting the feed to the cows. It can not be eliminated.
7. Go to granary. The purpose is the same as for item 3. But what is the purpose of the second trip? Three bushels are needed for one feeding. That is too heavy a load for one trip. It is necessary to get the feed to the cows, but it is not necessary to carry it. If it were rolled in a cart, a larger quantity could be brought at one time, reducing the number of trips. If this cart were small enough, it could be rolled down the feed alley, and the feeding done directly from the cart.

8, 9, and 10. Same as 4, 5, and 6.

11. Go to feed alley at No. 1. The first purpose is to return the basket to a position that will be convenient for the next feeding. The second purpose is to get to the sack of high-protein feed. Although this trip is necessary, the distance traveled might be reduced by locating the basket and sack of feed in different places.
12. Set down basket. This is necessary in order to perform the next operation.
13. Fill pail with high-protein feed from sack. The sack is too heavy to carry, and it would be hard to feed from a sack.
14. Pick up pail. This seems necessary.
15. Feed cows Nos. 1 through 10. The primary purpose is to get the feed to the cows. This operation is necessary.
16. Go back past cow No. 1 and across to cow No. 11. It is necessary to go across to the other row of cows to feed them.

The distance traveled would be shorter if there were a cross walk from No. 10 to No. 19.

17. Feed cows Nos. 11 through 19. The purpose is the same as in item 15.
18. Go to feed alley at No. 1. The purpose is to return the pail to the sack where it will be conveniently available for the next feeding.
19. Set down pail, permitting the worker to go to other jobs.
20. Go to other work.

b. *Where* should the work be done?

Steps 1 and 2. Get basket. Some travel would be saved if the basket were located near the door opening to the granary. The basket would interfere with other work if left there, however.

3 through 10. Is the granary the best place to keep the ground feed? Could it be more conveniently stored in the barn? On this farm the granary provides a rat-and-mouse-proof storage space. It is a convenient central storage and grinding place for feeds that will be used for hogs and poultry as well as for cattle. It would take from 20 to 25 minutes to haul 50 bushels to the barn. It takes 35 minutes to carry the same quantity.

11 and 12. Return basket. It would require less time and travel to return the basket to the door (see items 1 and 2).

13 and 14. Get high protein-feed. It would save walking if the sack were left by the door or in the feed alley by cow No. 11.

15, 16, and 17. Feed cows. This must be done in the present location—where the cows are located.

18 and 19. Return pail. This will always require a trip from one feed alley to the other to return the pail to the sack.

c. *When* should the work be done? Feeding cows Nos. 1 through 6 and 7 through 12, grain after silage, as is done now, is as convenient as any other time for this farmer. If cows Nos. 11 through 19 were fed first, the worker would finish feeding near the sack of high-protein feed, eliminating the necessity for one trip across the barn.

13 through 19. All cows receive the same proportion of grain and high-protein feed. These two could be mixed when grinding. They could then be fed at the same time, eliminating an extra trip for high-protein feed. The extra time needed when grinding would be approximately equal

to the time required to carry the sack of high-protein feed from the granary to the barn.

d. *Who* should do the job? A 21-year-old son does the work. Since he is the strongest, he can best do this heavy job. But he and his father could spend more time in the field if the 12-year-old son could do the feeding during the summer. This boy could not carry a heavy basket. It would be necessary for him to make a large number of trips with pails.

e. *How* should the job be done? The previous analysis indicated that a cart might be used to advantage. In order that the cart might roll easily over rough ground, it was built on bicycle wheels. A box holding six bushels provides a full day's feeding, and yet is convenient to push through doors and passageways, and is not too heavy for the wheels.

3. Develop an Improved Method. The questioning of details of the job may suggest improvements in working methods. These improvements must be combined into a specific plan for doing the job. Listing the details of the proposed method in a manner parallel to the listing of the details of the old job will help to clarify the planning and to preserve the plan for future use.

a. The questioning of the purpose and reason for the job may reveal operations that contribute little or nothing to the final product. These may be eliminated.

b. The questions of where the job shall be done, when it shall be done, and who shall do it may suggest opportunities for rearranging the work for a better sequence or possibilities for combining two or more details into one operation.

c. The question of how the job shall be done will have suggested changes in body movements to permit better posture, to reduce travel, or to permit the entire body to work more efficiently. It may also have suggested possibilities for rearranging fences and buildings, for relocating supplies and equipment, or for redesign or addition of equipment. In some cases this question may merely call attention to the need for improvements. Farmers, farm papers, experiment stations, and other sources may be consulted for specific ideas for improvements. The outline of new methods will provide a sound basis for combining ideas secured from others into an efficient method of working.

In developing the new method for feeding cows, the grain and

high-protein supplement were mixed while grinding. The cart described above was used for feeding. The details of the revised job of feeding were:

Step 1. Go to cart at cow No. 1.
2. Get cart.
3. Wheel cart to granary.
4. Fill cart with shovel.
5. Wheel cart to cow No. 1.
6. Feed cows Nos. 1 through 10, pushing cart with one hand and using grain scoop with other.
7. Wheel cart back past cow No. 1 and across to cow No. 11.
8. Feed cows Nos. 11 through 19.
9. Set cart at No. 19.
10. Go to other work.

At the second feeding the details were:

1. Go to cow No. 19.
2. Get cart.
3. Feed cows Nos. 19 through 11.
4. Wheel cart across to cow No. 1.
5. Feed Nos. 1 through 10.
6. Wheel cart back to cow No. 1.
7. Set cart in feed alley at No. 1.
8. Go to other work.

4. Use the Improved Method. The final step in developing improved methods is to put into practice the improved procedure developed by the study. This method may seem awkward at first because old habits must be broken, but if the new procedure is used until skill is acquired, considerable time may be saved.

The time required for two feedings under the new method was 6 minutes. The average time per feeding was reduced from 6½ to 3 minutes. The distance traveled was reduced from 800 feet to 300 feet. In the course of a year that represents a saving of 42 hours of time, or about 4 work days, and 35 miles of travel. Not only was time and travel saved, but the work was easier. The 12-year-old boy was able to do the feeding almost as quickly as his 21-year-old brother.

Results obtained from the study of individual jobs may seem meager. Individual savings may be small but the opportunities for such savings are so numerous that a large total saving may be obtained. In one study on a Vermont dairy farm the time required for performing the daily chore work on a 22-cow herd was reduced from 5 hours, 44 minutes per day to 3 hours, 39

minutes. The distance traveled in performing this chore work was reduced from 3¼ to 1¼ miles. This large total saving was the accumulation of a large number of small savings. Very few changes resulted in large savings. A summary of the changes made and the time saved on each of the chore operations illustrates this.

Barn Rearrangement. The principal changes in the barn were (1) placing the cows in two nearly equal rows instead of in a long and a short row; (2) opening a cross alley at the north end of the stanchion line, so that it was possible to pass completely around the cows in the performance of a given chore; (3) cutting a new door in the east wall of the barn; (4) moving the horses from the west side of the barn to the northeast corner, near the new exit door; (5) removing the partition around the sawdust bin and silage chute.

Improvement of Equipment. The principal items of new equipment were a grain cart, silage cart, specially designed wheelbarrow, teat-cup rack, and rinse-pail carrier. Changes were also made in small tools, as the grain scoop, silage fork, floor brush, shovel, and hoes.

Improvement of Work Routines. The main changes in routines were the inauguration of a four-minute milking machine interval and the development of quick stripping habits in cows and milker. Many small changes, designed to hold unproductive travel and work to a minimum, were made in methods and in the order of operations and jobs.

Improved Positioning of Equipment and Supplies. Good work routines and positioning of equipment and supplies are closely related. Two work centers were established, one for general chores and the other for milking. The first is in the northwest corner of the barn. Here the silage chute and the sawdust bin are located, grain and lime are stored, and the grain cart, silage cart, wheelbarrow, and the forks, shovels, and brushes are kept. Most chore jobs with the cattle, except milking, start in this area, move either around the barn in a circuit of the stanchion line, or up the center feed alley and back, and end near their starting point. The second work center is at the southwest corner of the barn. Here the milker is assembled before and rinsed and taken down after milking, the teat-cup rack and the switch which controls the milker motor are located, and the pulsator, air hose, milking stool, and rinse pails are kept when not in use. The milking starts with the first two cows in the near-by row and moves around the barn in a clockwise direction.

The following table summarizes the savings in time and travel:

TABLE LII—DAILY TIME AND TRAVEL DURING CHORES 1

	June 29, 1942*		Oct. 21, 1942*		Savings	
	Time	Travel	Time	Travel	Time	Travel
	Minutes	Feet	Minutes	Feet	Minutes	Feet
Milking jobs†	195	5,699	118	2,896	77	2,803
Care of milk utensils	42	2,362	23	827	19	1,535
Graining cows	6	771	6	293	....	478
Feeding silage	26	2,070	15	199	11	1,871
Feeding horses and cleaning horse stable	12	1,112	7	398	5	714
Tying and releasing cows	9	982	9	710	....	272
Spraying cows	3	457	3	283	....	174
Cleaning alleys and walks	14	888	11	295	3	593
Cleaning cow stable	19	1,180	15	345	4	835
Spreading lime and sawdust	18	1,679	12	299	6	1,380
Total	344	17,200	219	6,545	125	10,655

* Silage was not being fed on either June 29 or October 21, and the cows were not sprayed nor was lime spread in the gutters on October 21. For these jobs the comparisons are between dates as follows:

Feeding silage—November 18, 1942, and January 14, 1943.
Spraying cows—June 29 and September 17, 1942.
Spreading lime—June 29 and September 17, 1942.

† Clean during milking, care for milk, operate milker, wash udders, hand milk and strip, wait during milking, care for injured teats.

1 Labor Saving Through Farm Job Analysis, R. M. Carter, Vermont Agricultural Experiment Station Bulletin No. 503, June, 1943. Pages 61-62.

CHAPTER XXV

EQUIPMENT FOR ECONOMIC OPERATION

The equipment of a farm begins with buildings to house the operator and his family, to shelter his animals, and to store the products of the farm. It continues in the provision of power and implements for tilling the land, in processing crops, and in providing foundation herds of productive livestock to round out the production program. It is completed by the provision of convenience or ease-giving equipment. Those with limited funds are wise to be conservative in their investments in the latter group until production is established and income assured. The individual operator must study these problems as related to the farm under operation. He should erect buildings, provide power, and buy machinery only as it can be shown that the income from the farm will be increased, that the labor of himself and family will be decreased, or that the comforts and satisfactions of the home will be greater than before. There is no argument against buying equipment to ease or reduce the labor load on farms not under financial stress or where income is large enough to permit the expenditure without limiting funds for other demands.

BUILDINGS IN RELATION TO THE FARM

In the long run the land must support the buildings. The wealth comes from the land. Few buildings return a direct profit on the money invested in them. On the contrary, as soon as erected they begin to depreciate. There is expense annually for upkeep and maintenance, and this expense must be met by income from the farm. That there is a close relation between the land and the buildings can be demonstrated in almost any county in the United States. A survey of the farms, township by township, will show that the best buildings, as a rule, are to be found on the best land. The farms on which the buildings are poor will be found on examination to have land of poor quality. It is difficult indeed to pay for high-cost buildings from the earnings of farms established on poor soil. One setting out to equip a farm with buildings should consider not only the funds immediately available but the probability of annual and long-time income.

The cost should be within the earning power of the land.

THE FARMHOUSE. How good a house should a farm family have? The correct answer to that question is: *The best the farm can afford and support.* A good house undoubtedly adds to the value of a farm as a home and increases its selling value. It does not, however, add in any way to production or income from the farm. It is more likely to be a bill of expense. The depreciation and upkeep annually will amount to 3 to 5 per cent or more on the investment. Insurance should be carried, which is an additional expense. The operator must have a house for his family to live in, but it is not a productive factor in the farm business. In providing a farmhouse, the desire for comfort and the personal satisfaction of living in a good home must be weighed against the possibilities of paying for it and supporting it from the earnings of the farm on which it is located. It is better to begin with a modest and reasonably-priced house and to improve or replace it when earnings will permit than to overbuild and incur the danger of financial embarrassment. On the average farms of the United States an investment of $1,000 to $3,000 for a farmhouse is as much as should be charged against the farm unit. Some farmhouses are valued higher than the figures given above, but they contribute no more to the farm income than more modest homes. A part of the cost of such houses should be considered as a personal expense of the operator.

BARNS AND OUTBUILDINGS. Barns and outbuildings, like houses, are provided and maintained at an annual expense for upkeep, repairs, and insurance. To meet that expense they must shelter productive livestock, protect feed supplies, and prevent deterioration of machines, implements, and other equipment. The returns from such buildings are indirect and not easily determined; yet the buildings are indispensable. Buildings on farms in the northern dairy and hog region are much more numerous and expensive than those on farms of the South or of the Great Plains wheat or range regions. They are also more necessary. Warm barns and comfortable stalls are required in the North where winter dairying is widely practiced. To be warm and comfortable, barns need not be unduly expensive. It is far more important that they be well planned, and fully occupied than that they be large and pretentious in appearance. Comfort for the animals housed, and convenience in storing feed supplies are the first considerations. Of equal importance is the matter of labor saving in the daily care of the animals housed. While such matters originate in the

organization of a farm, they must be considered frequently by the farm operator in planning his work program. It often is good economy to relocate a building or rearrange the interior of one to lessen the labor required in doing the daily chores.

Granaries, corncribs, and other feed-storage buildings should be placed conveniently near where the feed is to be used. One must remember that feeding must be done two or three times a day every day in the year. It is important therefore that feed supplies be well placed. The same arguments apply in the placing of a machine shed, garage, or workshop. These buildings need not be expensive, but they should be well placed and well planned.

Farm Building Investments. Most farm buildings represent a long-time investment. Many substantial farm buildings may, with ordinary repairs, last the lifetime of two or three generations of farmers. During this time economic conditions may change so that a building is no longer needed for its original purpose. Livestock practices may have changed sufficiently to make the building obsolete after a period of years. This makes it especially important to limit the expenditure for farm buildings to the minimum that will meet requirements of protection, comfort, and convenience.

It may be wise to sacrifice some length of life of the building in favor of low cost construction. Changes that must be made in the long-lived building to meet changed conditions are expensive, and the reconstructed building is not likely to serve the purpose as well as a new one. Low cost and relatively short-lived buildings are safer from an investment standpoint than more permanent but more expensive buildings.

It is a matter of common observation that many farms are sold for less than the replacement cost of the buildings. Studies by Ezekiel [1] in Pennsylvania, and Ranney [2] in Minnesota, and others, indicate that, in the case of small investments in farm buildings, their full cost may be added to the sale price of the farm. In some cases such investments may make possible the addition of even more than their cost. However, as the investment per farm or per acre increases, the sale price of the farm does not increase by corresponding amounts and the point is finally reached beyond which additional expenditures for new building construction add nothing to the sale value of the farm. From a business investment standpoint, extreme caution should be exercised to keep the cost of farm buildings to the minimum needed for efficient operation

[1] *Bulletin 1400,* U. S. D. A., April, 1926.
[2] *Bulletin 314,* Minnesota Agricultural Experiment Station, December, 1934.

of the farm. However, many farmers get a considerable amount of personal satisfaction out of large, expensive, and attractive barns and other farm buildings. The construction of such buildings becomes not a business investment but a consumptive expenditure. Money spent this way may give the farmer and his family more satisfaction than they could get from any other use. Unfortunately, the farmer too often constructs these expensive buildings with borrowed funds. The satisfaction that he gets from his attractive building layout cannot be converted into cash to meet interest and principal payments to the creditor.

There is no simple rule by which the limit of profitable investment in farm buildings can be determined. The returns come in terms of labor economy, increased or more efficient livestock production, or better quality or higher priced products as the result of storage or processing. In case of livestock shelters, one common "rule of thumb" is that the total investment in shelter for any class of livestock should not exceed the value of the annual product of that stock. If a dairy cow produces 250 pounds of butterfat per year worth 50¢ per pound and a calf worth \$5.00, the total expenditure per cow for shelter of the cow and the usual replacement stock and feed for them should not exceed \$130 ($250 \times \$.50 + \$5.00 = \$130$). This would limit the cost of a dairy barn for a herd of 20 cows with the bull and young stock to \$2,600. This amount would have to cover the cost of the silo or the share of other buildings used to shelter feed for the dairy herd. The same rule may be applied to other classes of livestock. These are only rough approximations at best. Obviously the same quality of structure will cost more in some sections of the country than in others. This rule does, however, serve to stress the fact that investment in livestock shelter should be proportionate to income. A more productive herd or flock or a premium price for the product may support a materially higher building investment per animal but unless the more expensive building contributes to the increased production or price, it can hardly be justified from a purely economic standpoint.

An illustration of a method of computing how much may be spent for shelter for a dairy herd and for the feed that must be stored to feed the herd is shown in Table LIII. All costs except labor and shelter have been deducted from gross income per cow in order to determine how much will be available to reimburse labor and to cover building costs. The amount available for investment in shelter after allowing a wage to labor is shown on a per-cow

basis and also on the basis of a 15-cow herd. The latter figure is a little easier to visualize since one usually thinks in terms of investment in a barn (or barn and silo) for the whole herd including replacement stock, rather than in the terms of investment per cow.

It is obvious from this calculation that the higher the rate the farmer must pay for labor the less will be available for building construction. However, most of the labor used in dairy pro-

TABLE LIII—SUMMARY OF COSTS AND RETURNS FOR DAIRY CATTLE,* 1932-1943[1]

Items	Low Producing Herds		All Herds		High Producing Herds	
Pounds butterfat per cow	175		232		299	
Man hours per cow	140		157		191	
Costs:						
Feed	$55.16		$64.64		$76.41	
Horse work	.63		.66		.72	
Equipment	3.31		4.58		6.48	
Interest (on value of cattle)	4.26		4.47		5.38	
Misc. cash expense	1.33		2.21		3.99	
Total	$64.69		$76.76		$92.98	
Manure credit	5.15		5.95		6.90	
Net		$59.54		$70.61		$86.08
Value produced:						
Dairy products	$63.54		$86.30		$115.94	
Animals	31.29		36.24		40.82	
Total		$94.83		$122.54		$156.76
Residual to shelter and labor		$35.29		$51.93		$70.68
Residual to shelter with labor at						
20c per hour	7.29		20.53		32.48	
25c per hour	.29		12.68		22.93	
30c per hour	.00		4.83		13.38	
Possible investment in shelter, capitalized at 8% with labor at	Per cow	Per 15 cows	Per cow	Per 15 cows	Per cow	Per 15 cows
20c per hour	$91	$1,365	$257	$3,855	$406	$6,090
25c per hour	4	60	158	2,370	287	4,305
30c per hour	0	0	60	900	167	2,505

* (All dairy cattle on a per-cow basis.)

duction is supplied by the farmer and his family. If the farmer spends too large a proportion of the dairy income for shelter, he and his family must accept a low return for their services. Such a calculation in advance of building, may obviate the occasion for sacrificing the standard of family living in order to have an expensive dairy barn.

[1] Farm Business Notes. University Farm, St. Paul, No. 270, June, 1945.

Another significant point derived from this table is the relationship between the productivity of the herd and the amount available for labor and buildings. In this case, the farmer with the high-producing herd has twice as much income available for labor and building costs as the man with the low-producing herd. Since the amount of labor required does not increase as rapidly as production, a larger proportion of the increased income is available to cover building costs. Extreme caution should be exercised in making investments in shelter for low-producing livestock, especially if it is necessary to borrow money for the purpose. The more productive the livestock, the larger the amount that may be safely invested in shelter for them. Any increase in the price received for livestock or livestock products operates to support a higher investment in shelter in the same manner as does increased production insofar as the cost elements involved in production are not changed or at least not increased proportionately.

The fact that high-producing livestock will support more expensive shelter does not in itself justify spending more for buildings for them than would be needed for a herd of average production. Only as more expensive buildings would increase the value of the total product of the dairy herd or decrease some element of cost would the increased building investment be justified. On the farms for which data is shown in Table LIII, the investment in dairy buildings per cow for the high-producing herds was only 16 per cent more than that for the herds with low production, even though the residual to shelter and labor was twice as high. More of this residual is therefore available to the farmer for his labor and management.

Insofar as an increased investment in buildings reduces the labor required in livestock production it may be economic. If additional buildings or more expensive construction for the herds reported in Table LIII enabled a saving of 10 hours of labor, per-cow annual costs would be reduced by the cost of this labor. If farm labor costs 25¢ per hour, the average rate for the 12 years included in this study, the saving would amount to $2.50 per cow per year. Capitalized at 8 per cent, this represents a sum of $31.25. If the additional building investment required to effect this labor saving was less than $31.25 per cow, it would more than cover the cost. If labor cost 40¢ per hour, an additional investment in buildings up to $50 per cow might be justified. The higher the cost of labor, the more important is this item of labor saving. On the other hand, the dairyman who handles his herd with unpaid

family labor that otherwise would have no alternative employment, would gain no monetary advantage through labor-saving investments.

This same type of analysis may also be used in computing the amount of investment that may be justified in shelter for other classes of livestock. As in the case of farm budgeting discussed in Chapters XVI and XVII, a little advance planning and calculation may avert costly mistakes in building investment. This is especially important when funds for building construction must be borrowed.

Water Supply. Most important of all is a good water supply with water accessible at will to all classes of livestock and to the household. Attention has been frequently called to the need for water, by both plants and animals, in promoting the normal bodily functions required for growth and production. Stock that must be taken to water or have water carried to it is almost sure to be undersupplied. Less labor is required if water tanks can be provided at convenient places in barns, yards, and pastures where the animals can drink when the desire for water is felt. Farm records show, too, that the best gains and production are obtained when livestock has free access to water. On most farms access to water can be given by well-arranged yards suitably fenced, with troughs or tanks at convenient points. A few dollars spent for fencing, tanks, and piping will not only save labor but often increase the income from livestock.

FARM POWER

In considering the matter of power and machine use one must keep in mind the primary purpose or objective. It is to enable the operator to minimize the amount of man labor required to operate the farm. Power would be of little value except it be used to drive machines or implements that reduce the amount of labor done by hand. Machines are, in fact, substitutes for human labor in doing the farm work.

The kind of power to be used on a farm properly should be determined when the organization plans are made for the farm. The farm operator must always be alert, however, to changing customs and the wisdom of changing as progress is made. Three forms of power are in use on American farms. These are (1) animal, (2) internal combustion engine, (3) electric. Of these, animal power is most widely and universally used, though rapidly being displaced by tractors. Electric power is also gaining favor

rapidly for belt work, but is not yet adapted to field work requiring portable power. It is not uncommon to find two of these forms of power used on diversified farms. On many well-equipped, large farms with a diversified production program all three forms may be used to advantage. The form or combination of forms of power to use can be determined only by a knowledge of the power demands for a given farm. A discussion of the characteristics of each form may be helpful in meeting the problem.

ANIMAL POWER. (Farming is a business where the turnover of capital is slow. It is a business, therefore, that is not well adapted to large cash costs.)

One of the advantages of horse power is the low cash outlay required. The farm work may well be done by brood mares capable of producing their own replacements. They may be kept almost entirely on farm-grown feeds, and cash outlay may be thus avoided. Horse power may be used in adaptable units of one, two or three, to twenty horses, depending on the load to be moved or the work to be done. It is true that large teams of horses require more time for their daily care than tractors; but, again, this is not an out-of-pocket cash cost. The operator who has plenty of land and family labor and who is limited in cash for operating should seriously consider continuing to use horse power for his field operations. This power is particularly advisable where machines and implements are made for horses, and a change in power would involve a new line of machinery. The problem must be considered from the long-time point of view and a changeover, if contemplated, should be made gradually as it can be afforded.

TRACTOR POWER. Farm tractors are increasing rapidly in numbers and adaptability. This fact must be construed to mean that farmers are finding them satisfactory as sources of power. Some of the reasons for their advantage are plainly seen. A tractor can serve in the field more hours a day than is physically possible for horses. By changing operators it can be used 12 to 18 or even for 24 hours a day. With suitable equipment, a higher rate of travel is possible and an operator can accomplish much more in the same number of hours than he can with horses. The ability to get the work done when the weather and the season are favorable accounts largely for the rapid substitution of tractors for horses as a source of farm power. That the tractor requires neither fuel nor care when not at work is another point of advantage in gaining popular favor.

Against these advantages must be weighed the heavy initial

PLATE XXI. PRODUCING HOME SUPPLIES

A good farm garden, suited to the size and needs of the home, will save expense for foods and add to the health and enjoyment of the family. Courtesy Bureau of Plant Industry.

PLATE XXII. A ROADSIDE FARM MARKET

Farmers at strategic locations may find ready sale for fruit, vegetables, eggs, and other farm products at an attractively arranged roadside stand.

Plate XXIII. The poultry house

Self feeders, self waterers, and easily cleaned roosts economize labor, add to the comfort of the fowls, and cut down the cost of egg production. Courtesy Farm Credit Administration.

Plate XXIV. A frozen-food locker

A cold-storage locker makes it possible to preserve meat, fruit, and some vegetable products in fresh form until wanted for the table.

cash cost of the tractor, the cash cost for replacement, the cash expense for fuel, oil, and repairs, and the difficulty of adapting the available tractor power to the kind and size of the work load to be done. Skill and mechanical ability are essential qualities in the satisfactory and efficient use of a tractor. It is important also that the tractor be of a type adapted to the size of farm operated and to the kind of work to be done.

RELATIVE COST. Many studies have been made of the comparative costs of horse and tractor power. The cost per hour for each is quite generally shown to depend upon the number of hours of work performed during the year. Since the overhead expense for providing and maintaining power are nearly constant in either case, it naturaly follows that the more hours of service given, the lower the cost per hour for the service. While there is a wide variation in the cost per hour of animal power from farm to farm, averages reported for groups of farms where records have been kept usually range from 15 to 20 cents for horse work. A two-horse team at ordinary farm work would, therefore, be figured at 30 to 40 cents an hour unless records for the individual farm show the cost to be more or less than the figure indicated.

Tractor costs per hour are somewhat more difficult to determine because of the wide variation in tractor types and in the work performed. The annual cost of maintaining a tractor capable of pulling a two-bottom plow will range from $200 to $400. The annual cost of maintaining a tractor capable of pulling a two or three-bottom plow varies widely, ranging from 45 to 50 cents an hour to 80 or 90 cents depending in large measure on the efficiency of the operator, the number of hours used annually, and the price of fuel and oil.

To pull a two-bottom plow comfortably through the plowing season would require five horses. Figured at the low cost of 15 cents and hour, the cost for horse work would be 75 cents which is somewhat higher than the average cost per hour for tractor power. Since a tractor travels at a faster pace than horses, more land will be plowed in a day. An acre per day per horse is the usually expected result from a horse-drawn plow. A tractor-drawn plow of the same size will turn 7½ acres per day. The power cost per acre with the horse-drawn plow would be $1.50 as compared to $1.00 for the tractor-drawn plow. Before deciding that a tractor should be used, one must consider the greater cash cost involved in its use and the work other than plowing that can be done with it on the farm under consideration. In doing light work requir-

ing only one or two-horse power with a heavy tractor costing 80-90 cents an hour to operate, the expense for power would be much higher than if horses were used.

ELECTRIC POWER. The use of electricity on farms is rapidly increasing. Up to the present time its use is limited almost entirely to belt work and the operation of convenience equipment designed to lighten the labor of the family in doing the routine chore work of the household and farm. Its most universal use is for lighting the farm buildings. On many farms where heavy field work requiring much power is limited, a combination of animal power for field work with electricity for belt work and household use may be more economical than tractor power. No fixed rule can be laid down for making such combinations, but farm operators should figure carefully on the relative merits and costs of each form of power available to them.

MACHINERY AND IMPLEMENTS

There is almost no end to the supply of machines, implements, and tools devised to be useful in the operation of a farm. Which ones should the operator buy? How can he decide which is within his means to buy and be most useful in doing the farm work? The answers to these questions and to many others that will come up lie in the nature and amount of work there is to do. How much tillable land is there? How much of it must be plowed annually? How many acres of grain will there be to harvest? Of corn to be harvested? Of hay to be cut? And thus through the list. Perhaps it would be cheaper to hire a neighbor to cut the grain than to buy a machine. These are all problems that must be solved for each individual farm. There is no direct solution for them, but there are principles of economy that will help, if used, in finding the right solution.

MAXIMUM USE IMPORTANT. Attention has already been called to the importance of getting a large amount of work from each unit of power (horse or tractor) in reducing the cost of power. It is equally important that each machine or implement be fully employed on productive work, if income is to be made on its use. The first matter to consider is the kind and amount of work to be done. For example, on my 320-acre farm how many acres of grain are there to harvest each year? How many acres a day will the contemplated machine harvest? What is the length of the harvest season? Let us assume that there are 200 acres of small grain to harvest annually. With tractor power and an eight-foot,

self-binding harvester drawn at 4 miles per hour, 27 acres per 10-hour day can be cut. Not allowing for breakdowns or delays, approximately 8 days will be required to harvest the crop. The length of the harvest season is determined by the condition of the crop. To be at its best in yield and quality, grain should be harvested just at maturity. If harvested too early, there is loss in yield. If harvest is delayed much past maturity, there is likely to be loss in quality from bleaching or coloring. There is danger also of loss from hail or heavy rains. Part of the grain crop is barley, part early oats, and the balance, 120 acres, is spring wheat. These grains ripen in succession and all can be harvested with the machine contemplated. The machine could well be used for a greater number of days, but there is no more work for it to do. Eight days is more than most binders are used, so that costs for ownership and daily use are relatively low. Davidson, of Iowa State College, gives $32.62 as the annual cost for ownership of a self-binding grain harvester.[1] This cost, spread over the 200 acres of grain harvested, makes the cost per acre for binder use 16.3 cents. The same annual cost would be met if only 100 acres were cut, but the cost for binder use per acre would be doubled, or 32.6 cents. The same method of calculating would apply to all machines or implements used in growing the grain crops. Obviously, the cost of producing grain would be reduced by getting the maximum seasonal use from each machine.

Few machines are used to their full capacity either in the number of days operated annually or in the amount of work done daily. The efficiency or capacity of a machine is based on the speed at which it is driven and the steadiness of operation. The use of the machine on most farms is interrupted by the demands on the time of the farmer for chore work and emergencies which frequently arise. Insufficient or poorly-adapted power for driving the machine may reduce its efficiency also. These are all matters that lie within the ability of the operator to correct.

Determining Cost for Machine Use. Few farm operators recognize fully the costs that must be met in providing machinery for operating. A study of the annual cost for maintaining each machine of major importance will be helpful in determining whether or not it is wise to buy. The first step in such a study is to consider the factors of cost in maintaining a machine. These may be listed as (1) depreciation, (2) interest on investment, (3) repairs, (4) housing, (5) miscellaneous. A sample formula for

[1] *Bulletin 260*, Iowa Agricultural Experiment Station.

determining each of these annual costs is given below.[1]

1. Depreciation $= \dfrac{\text{First cost}}{\text{Estimated life in years}}$

2. Interest $= \dfrac{\text{First cost} + \text{annual depreciation} \times \text{rate}}{2}$

3. Repairs = Estimated percentage of first cost or annual records and experience.
4. Housing = Cost per unit of space occupied @ estimated rate.[2]
5. Miscellaneous—any other cost not included above.

The use of this formula is illustrated in the following example of the cost of using a grain drill.

Assume: 20 x 6 drill, first cost $220.00, life 18 years, rate of interest 6 per cent, annual acreage 90, acres per day 15.

1. Depreciation $= \dfrac{220}{18}$	=	$12.22
2. Interest $= \dfrac{220 + 12.22 \times .06}{2}$	=	6.97
3. Repairs = 0.5 per cent of first cost	=	1.10
4. Housing = $12' \times 6' \times .02$	=	1.44
Total annual cost	=	21.73
Cost per acre $= \dfrac{21.73}{90}$	=	.24
Cost per day = $.24 \times 15$	=	3.60

The same formula can be used for determining in like manner the annual cost and the cost per day or per acre for any other machine. It may be used also in determining the fixed costs for the use of a tractor. To the fixed costs for the tractor the costs for fuel and oil and other lubricants must be added. The costs for these items must be determined from experience or, better yet, from records of amounts actually used.

A formula is included here also for determining machine capacity per hour in acres. It is governed by the width of the machine and the speed at which it is driven.[3] This formula will be useful to ascertain the expectancy for any proposed machine use and in deciding what size to buy.

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[1] Unpublished formula from Division of Agricultural Engineering, Minnesota Agricultural Experiment Station.
[2] The rate per square foot of space occupied is often figured on the basis of 10 per cent of first cost of shelter. A machine shed 20 x 50 costing $200.00, or an annual cost of $20.00 would provide floor space at 2 cents per square foot.
[3] Division of Agricultural Engineering, Minnesota Agricultural Experiment Station.

Machine Capacity—

$$\text{Acres per hour (theoretical)} = \frac{\text{S. W. } 5280}{43560}$$

S = speed in miles per hour
W = working width of machine in feet.
Assume 17.5 per cent time lost in turning.

$$\text{Then acres per hour} = \frac{\text{S. W. } 5280 \times 82.5}{43560 \times 100} = \frac{\text{S. W.}}{10}$$

$$\text{Acres per 10-hour day} = \frac{\text{S. W.}}{10} \times 10 = \text{S. W.}$$

This formula shows the normal working capacity of a machine in acres for a 10-hour day to be equal to the width in feet multiplied by the speed in miles per hour.

Few farmers keep records of the cost of the machines they use or of the days of use and service given by them. Research workers in agricultural experiment stations have made surveys and cost-accounting studies which supply data that will enable one to estimate with reasonable accuracy the life and possible service of many forms of farm equipment. The results of these studies are reported in experiment station bulletins and are available to anyone interested. To enable students to analyze the problems of equipment costs as they come up in class exercises, summary tables from two such bulletins are included. By substituting local prices and records of days of service on individual farms for those given in the table a close estimate of the cost of service for many machines and implements may be made.

The figures given in Table LIV may be used unless data from records kept on the project farm over a period of years are available. Where one can establish one's own first cost, life of machine, interest rate, cost of repairs, and housing costs, more accurate results can be obtained for the individual farm. There will be variations, too, in the number of days a machine is used which influence materially the cost for a day of service.

Table LV gives data on the annual expense of certain implements and on the distribution of that expense as between depreciation, repairs, and other expense on a group of Indiana farms. The "other items" include interest on investment, taxes, housing, and insurance charges.

The total annual cost of service in Table LV is given as a percentage of the first cost and may be applied to any first cost. In case the days of service vary from the normal average for a particular instance, a new cost per day may be obtained by

TABLE LIV—Cost of Use of Farm Machines in Dollars and as Percentage of First Cost [1]

Machine, power, size	Av. 1941 price	Av. life	Annual depreciation charge		Annual interest charge	Annual cost of repairs		Annual cost of insurance housing on taxes		Total annual cost		Average cost per unit of service*
	$	years	%	$	$	%	$	%	$	%	$	
Combine less than 5′	595	11.1	8.2	48.64	13.38	0.6	3.36	2.0	11.90	13.0	77.28	1.10
5′	625	9.9	9.0	56.30	14.08	3.5	22.11	2.0	12.50	16.8	104.99	.63
6′	650	11.6	7.5	48.75	14.62	1.4	9.42	2.0	13.00	13.2	85.79	.43
Cornpicker 1-row	400	13.3	6.9	27.69	9.00	1.9	7.47	2.0	8.00	13.0	52.16	.76
2-row	750	10.8	8.2	61.36	16.88	1.4	10.46	2.0	15.00	13.8	103.70	.64
Corn planter, horse, 2-row	85	21.4	4.3	3.67	1.92	1.4	1.22	2.0	1.70	10.0	8.51	.16
tractor, 2-row	110	18.4	5.0	5.50	2.48	1.1	1.21	2.0	2.20	10.4	11.39	.13
tractor, 4-row	220	14.9	6.0	13.20	4.95	.9	1.90	2.0	4.40	11.1	24.45	.12
Corn sheller under 60 b.p.h.	160	21.3	4.3	6.86	3.60	.5	.83	2.0	3.20	9.1	14.49	.01
60-70 b.p.h.	390	18.7	4.7	18.47	8.78	2.8	10.89	2.0	7.80	11.8	45.94	.01
over 70 b.p.h.	810	20.5	4.5	36.45	18.22	1.6	12.58	2.0	16.20	10.3	83.45	.01
Cultivator, horse, 1-row	55	22.6	3.9	2.13	1.22	1.8	.99	2.0	1.10	9.9	5.44	.09
2-row	95	20.3	4.5	4.25	2.12	1.6	1.50	2.0	1.90	10.3	9.77	.10
tractor, 2-row	120	16.4	5.6	6.75	2.70	1.7	2.01	2.0	2.40	11.6	13.86	.07
4-row	255	19.0	4.7	12.05	5.72	1.6	4.06	2.0	5.10	10.6	26.93	.07
Disk, single, horse, 8′ & less	65	23.4	4.0	2.57	1.48	0.7	.45	2.0	1.30	8.9	5.80	.07
9′-10′	75	21.9	4.1	3.05	1.68	1.2	.93	2.0	1.50	9.5	7.16	.06
11′-15′	90	22.9	3.9	3.52	2.02	1.1	.98	2.0	1.80	9.2	8.32	.06
tractor, 8′ & less	70	20.4	4.5	3.15	1.58	.5	.37	2.0	1.40	9.3	6.50	.04
9′-10′	85	19.2	4.8	4.05	1.92	1.4	1.15	2.0	1.70	10.4	8.82	.05
11′-15′	125	17.9	5.0	6.28	2.88	.8	.99	2.0	2.50	10.1	12.65	.05
Double disk, horse, 8′ & less	120	21.4	4.3	5.14	2.70	.6	.72	2.0	2.40	9.1	10.96	.11
over 8′	150	23.1	3.9	5.87	3.38	.3	.41	2.0	3.00	8.4	12.66	.14
tractor, 7′ & less	120	17.4	5.3	6.35	2.70	1.6	1.89	2.0	2.40	11.1	13.34	.08
8′	130	18.5	5.0	6.50	2.92	.6	.72	2.0	2.60	9.8	12.74	.06
9′	150	19.1	4.7	7.11	3.38	.9	1.34	2.0	3.00	9.9	14.83	.08
10′	160	20.3	4.5	7.20	3.60	.4	.66	2.0	3.20	9.2	14.66	.07
Ensilage cutter, field	615	14.2	6.4	39.50	13.82	2.1	12.61	2.0	12.30	12.7	78.23	1.02
stationary	330	18.5	5.0	16.50	7.42	2.3	7.69	2.0	6.60	11.6	38.21	.21
Feed grinder, hammer mill,												
less 40 b.p.h.	100	16.6	5.3	5.29	2.25	8.9	8.87	2.0	2.00	18.4	18.41	.02
41-80 b.p.h.	140	16.0	5.6	7.88	3.15	9.2	12.92	2.0	2.80	19.1	26.75	.02
over 80 b.p.h.	200	14.3	6.4	12.86	4.50	10.1	20.20	2.0	4.00	20.8	41.56	.02
plate, less 40 b.p.h.	35	19.5	4.4	1.55	.78	8.0	2.81	2.0	. 70	16.7	5.84	.01

[1] *Technical Bulletin 323*, Iowa Agricultural Experiment Station.

(Continued on page 315)

TABLE LIV—COST OF USE OF FARM MACHINES IN DOLLARS AND AS PERCENTAGE OF FIRST COST—(*Continued*)

Machine, power, size	Av. 1941 price	Av. life	Annual depreciation charge		Annual interest charge	Annual cost of repairs		Annual cost of insurance housing on taxes		Total annual cost		Average cost per unit of service*
	$	years	%	$	$	%	$	%	$	%	$	
Feed grinder, plate,												
41-80 b.p.h.	40	18.5	5.0	2.00	.90	8.3	3.31	2.0	.80	17.5	7.01	.01
over 80 b.p.h.	70	17.4	5.3	3.71	1.58	8.9	6.21	2.0	1.40	18.4	12.90	.01
Grain binder, horse, 6′	210	27.0	3.3	7.00	4.72	1.5	3.05	2.0	4.20	9.0	18.97	.77
7′	215	25.3	3.6	7.72	4.82	1.8	3.87	2.0	4.30	9.6	20.71	.61
8′	220	22.6	3.9	8.61	4.95	2.0	4.41	2.0	4.40	10.2	22.37	.53
tractor, 6′	265	21.7	4.1	10.86	5.98	1.3	3.36	2.0	5.30	9.6	25.50	.56
7′	275	22.9	3.9	10.74	6.18	1.3	3.58	2.0	5.50	9.5	26.00	.70
8′	355	21.3	4.3	15.19	7.98	1.3	4.56	2.0	7.10	9.8	34.83	.62
9′-10′	365	18.1	5.0	18.28	8.22	1.5	5.40	2.0	7.30	10.7	39.20	.48
Grain drill, horse, 7′ & less	155	27.0	3.3	5.15	3.48	.4	.67	2.0	3.10	8.0	12.40	.35
8′-9′	200	24.2	3.8	7.50	4.50	.2	.40	2.0	4.00	8.2	16.40	.56
10′ & over	255	24.0	3.7	9.54	5.72	.3	.67	2.0	5.10	8.2	21.03	.48
tractor, 9′ & less	185	25.2	3.6	6.68	4.18	.2	.45	2.0	3.70	8.1	15.01	.33
over 9′	290	22.3	4.1	11.86	6.52	.2	.58	2.0	5.90	8.6	24.86	.44
Grain elevator	275	25.0	3.6	9.88	6.18	2.6	7.08	2.0	5.50	10.4	28.64	.01
Hay loader, horse	145	20.9	4.3	6.24	3.28	.6	.90	2.0	2.90	9.2	13.32	.35
tractor	165	20.3	4.5	7.45	3.72	.7	1.20	2.0	3.30	9.5	15.67	.26
Manure spreader, horse	170	20.8	4.3	7.29	3.82	.8	1.32	2.0	3.40	9.3	15.83	.10
tractor	210	19.6	4.5	9.45	4.72	.5	1.13	2.0	4.20	9.3	19.50	.11
Milking machine	90	18.2	5.0	4.50	2.02	7.0	6.31	2.0	1.80	16.3	14.63	.96
Mower, horse, 5′ & less	95	21.9	4.1	3.86	2.12	2.4	2.28	2.0	1.90	10.7	10.16	.33
6′	100	21.4	4.3	4.29	2.25	2.0	1.97	2.0	2.00	10.5	10.51	.26
7′ & over	105	20.0	4.5	4.75	2.38	2.3	2.41	2.0	2.10	11.1	11.64	.31
tractor, 6′ & less	120	19.7	4.5	5.40	2.70	1.7	2.04	2.0	2.40	10.4	12.54	.27
7′ & over	130	16.2	5.6	7.31	2.92	1.5	1.99	2.0	2.60	11.4	14.32	.17
Plow, horse, 18″& less	75	25.3	3.6	2.68	1.68	1.1	.81	2.0	1.50	8.9	6.67	.32
19″ & over	100	24.5	3.8	3.75	2.25	1.3	1.29	2.0	2.00	9.3	9.29	.27
tractor, 18″ & less	95	17.4	5.3	5.00	2.12	2.5	2.41	2.0	1.90	12.0	11.43	.20
19″-36″	115	17.6	5.0	5.72	2.58	2.3	2.68	2.0	2.30	11.5	13.28	.19
over 36″	170	19.4	4.7	8.05	3.82	2.6	4.37	2.0	3.40	11.6	19.64	.20
Rake, horse, dump	55	24.8	3.6	1.96	1.22	.6	.32	2.0	1.10	8.4	4.60	.13
side delivery	120	21.6	4.1	4.91	2.70	.5	.60	2.0	2.40	8.8	10.61	.24
sweep	60	27.3	3.3	2.00	1.35	9.9	.51	2.0	1.20	8.4	5.06	.14
tractor, side delivery	130	20.9	4.3	5.57	2.92	1.4	1.81	2.0	2.60	9.9	12.90	.14

(Continued on page 316)

TABLE LIV—Cost of Use of Farm Machines in Dollars and as Percentage of First Cost—(*Continued*)

Machine, power, size	Av. 1941 price	Av. life	Annual depreciation charge		Annual interest charge	Annual cost of repairs		Annual cost of insurance housing on taxes		Total annual cost		Average cost per unit of service*
	$	years	%	$	$	%	$	%	$	%	$	
Roller, horse, 8′ & less	60	22.7	3.9	2.35	1.35	.0	.00	2.0	1.20	8.2	4.90	.10
over 8′	120	24.1	3.8	4.50	2.70	.2	.30	2.0	2.40	8.2	9.90	.11
tractor, under 12′	75	22.1	4.1	3.05	1.68	.4	.27	2.0	1.50	8.7	6.50	.06
over 12′	125	21.5	4.1	5.14	2.82	.8	.94	2.0	2.50	9.1	11.40	.07
Spike harrow, horse, 7′-11′	25	25.6	3.5	0.88	.58	.2	.05	2.0	.50	8.0	2.01	.03
12′-15′	35	25.3	3.5	1.24	.78	.6	.21	2.0	.70	8.4	2.93	.03
16′-19′	45	24.4	3.8	1.71	1.02	.6	.27	2.0	.90	8.7	3.90	.03
20′ & over	55	23.8	3.7	2.04	1.22	1.2	.66	2.0	1.10	9.1	5.02	.02
tractor, 15′ & less	45	22.5	4.1	1.86	1.02	.3	.14	2.0	.90	8.7	3.92	.02
16′-19′	50	23.4	3.9	1.96	1.12	.8	.39	2.0	1.00	8.9	4.47	.02
20′ & over	70	22.1	4.1	2.86	1.58	.8	.54	2.0	1.40	9.1	6.38	.03
Spring tooth harrow, horse, 9′ & less	30	19.9	4.5	1.35	.68	.8	.25	2.0	.60	9.6	2.88	.06
over 9′	65	22.2	4.1	2.68	1.48	.2	.13	2.0	1.30	8.6	5.59	.08
tractor, 7′-9′	45	20.3	4.6	2.05	1.02	1.0	.45	2.0	.90	9.8	4.42	.05
10′ & over	75	19.6	4.5	3.35	1.68	.8	.63	2.0	1.50	9.5	7.16	.06
Tractor, row crop†	950	12.5	7.5	68.40	19.00	1.5	14.02	2.0	21.38	12.9	122.80	
4-wheel	825	15.0	6.0	49.57	18.58	1.8	14.61	2.0	16.50	12.0	99.26	
Trailer†-2-wheel, factory	105	12.6	7.0	7.31	2.38	.0	.00	2.0	2.10	11.2	11.79	
4-wheel, factory	175	17.9	5.0	8.72	3.92	.8	1.36	2.0	3.50	10.10	17.50	
2-wheel, homemade	16	14.7	5.8	0.93	.35	6.9	1.11	2.0	.32	16.9	2.71	
4-wheel, homemade	26	14.7	5.9	1.53	.58	8.0	2.09	2.0	.52	18.2	4.72	
Truck, ½ ton†	800	10.9	8.2	65.45	18.00	1.8	14.13	2.0	16.00	14.2	113.58	
1½ ton	1225	12.8	6.9	84.85	27.58	1.8	21.95	2.0	34.50	13.8	168.88	
Wagon†	120	27.5	3.2	3.86	2.70	1.5	1.83	2.0	2.40	9.0	10.79	

*Cost per acre for field machines, cost per bushel for corn sheller, feed grinder, grain elevator, cost per cow for milking machines and cost per load for manure spreader.

†Total cost only. No data on total use.

TABLE LV—DISTRIBUTION OF TOTAL ANNUAL EXPENSE OF IMPLEMENTS [1]

Kind of Implement	First Cost of Implement	Annual Expense		Annual Expense For		
		Total	Per Cent of First Cost	Depre-ciation	Repairs	Other Items*
Wagon	$57.07	$4.56	7.99	$1.64	$0.67	$2.25
Hayrack	17.92	1.87	10.43	1.03	.13	.71
Gravel bed	6.49	1.11	17.10	.34	.51	.26
Truck	417.70	62.37	15.18	37.97	7.90	16.50
Auto (farm share)	303.92	47.85	15.74	31.33	4.52	12.00
Tractor	697.59	93.43	13.39	54.90	10.98	27.55
Gas engine	56.54	5.70	10.08	2.95	.52	2.23
Tractor plow	94.37	15.51	16.44	6.64	5.14	3.73
Tractor disc	80.28	8.73	10.87	4.64	.92	3.17
Walking plow	15.13	2.17	14.34	.66	.91	.60
Gang plow	44.48	5.08	11.42	2.22	1.10	1.76
Sulky plow	36.12	4.73	13.10	1.69	1.61	1.43
Disc harrow	45.51	4.48	9.84	2.45	.23	1.80
Spring harrow	21.06	2.07	9.83	1.02	.22	.83
Spike harrow	20.92	1.86	8.89	.99	.04	.83
Cultipacker	63.16	5.98	9.47	3.19	.30	2.49
Roller	20.12	1.57	7.80	.74	.04	.79
1-row cultivator	30.40	3.28	10.79	1.38	.70	1.20
2-row cultivator	68.40	7.24	10.58	3.41	1.13	2.70
Rotary hoe	81.47	8.36	10.26	5.12	.02	3.22
Corn planter	64.22	6.52	10.15	3.20	.78	2.54
Corn binder	105.30	10.44	9.91	4.97	1.27	4.20
Corn elevator	213.86	18.73	8.76	8.70	1.58	8.45
Grain binder	158.15	16.88	10.67	7.39	3.24	6.25
Grain seeder	19.73	1.79	9.07	.91	.10	.78
Grain drill	80.98	7.36	9.09	3.75	.41	3.20
Fanning mill	18.27	1.29	7.06	.57	.005	.72
Mower	54.47	7.05	12.94	2.78	2.12	2.15
Hay loader	79.39	7.21	9.08	3.75	.32	3.14
Hay rake	42.96	3.99	9.29	2.00	.29	1.70
Double harness	39.75	3.94	9.91	1.88	.49	1.57
Cream separator	74.46	7.51	10.08	4.07	.50	2.94
Brooder stove	18.42	2.22	12.05	1.42	.07	.73
Manure spreader	115.96	11.87	10.24	6.33	.96	4.58
Feed grinder	67.84	6.56	9.67	3.58	.30	2.68
Total of 35 implements	$3,332.41	$401.31	12.04	$219.61	$50.02	$131.68
AVERAGE FARM	$2,010.00	$242.00	12.04	$132.37	$30.25	$ 79.38

*Other annual expense was estimated for each machine as follows: Interest was charged at the rate of 5 per cent on average investment, or 2.5 per cent of new cost, during each year of service of the machine. Taxes were charged at the rate of $1.50 per $100 valuation, or 0.75 per cent of new cost, during each year of service. Housing was charged at 1 per cent of average investment or 0.5 per cent of new cost, during each year of service. Insurance was charged at the customary rate of $3 per $100 of insurance for a five-year period. It was assumed that machinery was insured for two thirds of its value. Hence, the annual cost of insurance was 0.20 per cent of new cost during each year of service. Therefore, "other annual expense" as used in this Table constitutes a flat charge of 3.95 per cent of new cost of implement.

[1] *Bulletin 437*, Indiana Agricultural Experiment Station, Table VI, p. 10.

dividing the total annual cost by the actual days of service.

THE FARM SHOP. There are endless small repair jobs on every farm. "Things to fix or make" accumulate daily. If these are all sent to a "town shop" a bill for repairs will run into a considerable amount by the end of a year. Many of these repair jobs can be done as well on the farm, if one is handy with tools and there is a place to work. A good-sized farm shop, properly arranged, deserves a convenient place among the farm buildings. It may well be a part of the machine shed where there is room to store articles needing repairs and where work can be done on rainy days or when there is a slack season in summer. Much of this work can be done in the winter season when pressure of farm work is lightest. A workbench, vise, forge, and anvil, with a few hand tools, such as saws, planes, chisels, drills, bits and brace, square, and hammer, will serve to start such a shop. These can be supplied as needs arise. An assortment of nails, screws, and bolts, suited to the needs likely to arise, is a necessity. In the North, provision should be made for heating the shop in the winter, so that one may work comfortably. Not only will the workshop save pocket expense for repairs, but it can be made a place where farm boys may gain needful experience in constructive or repair work.

✓CHAPTER XXVI

PRODUCING HOME AND FARM SUPPLIES

Usually there is a wide margin between the price a farmer gets for a commodity and the price the consumer pays for that same commodity on the local market. Estimates made by the Bureau of Agricultural Economics, United States Department of Agriculture, indicate that for the period 1935 to 1939 farmers received about 42 per cent of the consumer's dollar for an average of 58 food products sold.[1] Variations in the margin received for different classes of products are due in large measure to the amount of processing involved before the article is ready for use. On highly concentrated articles such as eggs, potatoes, dry beans, and dairy products, where but little processing is required, the farmer gets a relatively high percentage of the consumer's dollar. On others, such as canned foods, the percentage received may run as low as 15 to 25 per cent. If farm products are sold on a local market through the usual channels of trade, the farmer gets less than half of what the consumer pays. If at the same time similar goods are repurchased in processed form, the farmer pays a high price for foods that could be processed on the farm. This inequality is particularly true on the family-sized farm where the preparation and processing can be done in slack times or by labor that would not otherwise be employed. In periods of low prices for farm products it is especially important to provide home supplies so far as possible, as the share the farmer receives for his products declines rapidly. Farm families on limited income will be wise to provide as much of their food supplies from the farm as possible. They will thereby save out-of-pocket expense and increase the net cash income.

What has been said of the family food products will hold true also for feeds needed to carry livestock through the year. While farmers can often buy feeds from neighboring farmers at nearly the farm price, handling and transportation costs must be covered in addition to the price paid. If purchased at a local elevator or feed store, storage charges also will be added. If purchases

[1] *Farm Retail Price Spreads*, Bureau of Agricultural Economics, U. S. D. A., March, 1942.

must be made, they should be limited largely to grains and high-protein concentrates which can not so well be produced on the farm. An abundance of the grasses and coarse forages is possible on most well-planned farms.

FOODS FROM THE FARM

A satisfactory and healthful diet for the farm family requires a wide variety of foods. Many of the foods required can be produced on the farm, under planned production, if the needs are carefully considered.

More than half of the average ration for human beings is made up of carbohydrates, the class of foods represented by sugars, starches, and the fibrous material of food plants. Although the fibers are largely indigestible, they are of importance in providing the bulk of material necessary for the normal muscular action of the stomach and intestines.

Fats are essential to a well-balanced diet. Proteins and many of the fats are gained largely from animal sources in the form of meat, milk, and eggs. All these food elements, together with the vitamins now found to be so important in the human diet, are contained in cereal, vegetable, and animal products that can be easily grown on most farms. A discussion of the principal groups of food products follows.

Cereals. The cereals are regarded as the most important of all food sources. They form the major part of the food supplies for the human race. Wheat, oats, barley, rye, and rice are the principal cereals used for human food. Corn and sorghum grains, though not classed as cereals, are used also as food at times by many people.

Because the cereals, with the exception of rice, must go through one or more processing operations before they can be prepared for food, their direct use as food is negligible. Wheat must first be reduced to flour, which goes through many bolts or sieves before it comes out as white flour. Oats must be hulled and rolled before it is used as a breakfast food or for other purposes. Barley must be pearled or ground and refined before using, and rye also must be refined. For these reasons farmers frequently have their cereals processed at a local mill or exchange them for products already milled. In most cases, however, the cereals are sold or fed to livestock and the cereal food products needed by the family are purchased at the local store. Wheat may be cracked or ground into whole wheat flour for special uses, as

breakfast food, and even for coarse bread; but the quantity so used is negligible.

Potatoes. The Irish potato is one of the world's staple food crops. Because it needs no processing other than cooking before it is ready to eat, it is regarded as the "poor man's food." In centers of dense population where the climate permits its growth, it often forms the chief diet of families in the low-income class. Because it is a highly carbonaceous food, it should be balanced with protein and fat-bearing foods to insure good health. In most American homes potatoes are a regular part of the daily diet. For those engaged in heavy labor they are often served at each meal. Between three and four bushels of potatoes are required annually for each man, woman, and child in America.

The sweet potato, grown widely in the South, where the climate is not so well adapted to Irish potatoes, is also an important food crop. It is used principally in the South, where it replaces the Irish potato in the diet. Many sweet potatoes are shipped into the northern markets, however, where they find a ready outlet as a delicacy or to give variety to the diet.

Fortunately, both Irish and sweet potatoes can be safely stored for several months in cool cellars or in earth pits. Both crops are easily grown and there is no good reason why any farm family can not be liberally supplied with this staple food. Provision of five or more bushels for each adult, or equivalent, will give sufficient potatoes for use and seed for the next crop. The amount of land required will be small, as 100 bushels or more are normally produced on an acre. One fourth to one half acre will give enough for most families.

Vegetables. Every farm family should be provided with an abundance of vegetables, not only for summer use, but during the winter. The broad-leafed vegetables, such as lettuce, spinach, and Swiss chard, are rich in vitamins, when used fresh from the garden. Carrots, parsnips, rutabagas, squash, pumpkins, cabbage, and many others may be stored for winter use without processing. Tomatoes, sweet corn, string beans, peas, and others are easily canned or processed, in which form they may be kept indefinitely. A fair-sized, well-planned garden can be well cared for by the members of the family in odd moments not required for other tasks. The products from such a garden will pay good returns in health and satisfaction. It will, at the same time, reduce the expense for family food.

Fruits. Fruit-raising is, on the whole, a highly specialized

type of farming and best conducted only in areas especially adapted to it by soil and climatic conditions. This statement does not mean, however, that farmers advantageously located may not find it advisable to have a few fruit trees to supply at least a part of the family needs. A half dozen or more apple, pear, or peach trees, well cared for, will supply most families with fresh fruit in season and with a surplus for canning or storing. Many, however, must depend upon commercial orchardists for their supplies.

The small and bush fruits are adaptable over a wider area than the tree fruits. Where moisture conditions are favorable and family labor is available to provide the care, generous provision should be made for the small fruits. Strawberries, raspberries, currants, and gooseberries are easily grown. Used fresh, in the canned form, or as jams and jellies, they make a welcome addition to the diet. They will be used much more freely if home-grown than if they must be purchased.

ANIMAL FOOD PRODUCTS

While animal food products are usually more expensive than cereal and vegetable foods, they are much more commonly used. They are more expensive, because they have first been converted from plants into a more highly concentrated form as meat or milk by some kind of animal. There is always some loss of energy in such conversion and the animal that makes it takes toll for the service performed. They are more commonly used because of their palatability and nutritive qualities. They furnish the protein to complement the carbohydrates of vegetable foods. Nature must have a complete balance.

Dairy Products. Dairy products are highly regarded as foods. Physicians and dieticians prescribe milk liberally as food for infants, invalids, and even for adults in good health. Raw cow's milk is an almost perfect food. Cream, butter, and cheese are other forms of dairy products that are both nutritious and palatable. The milk, cream, and butter can readily be provided on most farms. For a family of five, two good cows will supply an abundance of these products.

To provide feed for two cows will require five to six acres of average farm land. For that reason, it may not be advisable for those operating small acreages to keep even one cow. Those on family-sized farms, however, can hardly afford not to provide one or more cows to furnish the family with dairy products.

Meat Products. Meat is a large factor in the diet of prosperous

people. It has been noted that those countries having the greatest wealth consume the most meat. Studies have shown that farm families eat more meat than the families of working men in cities. The reason is probably because farmers dress their own meat animals and, therefore, their meat costs less than where it must be purchased at a retail market. There is little difficulty in providing fresh meat for the farm family during the winter season, when the carcass of even a large beef animal can be kept indefinitely in frozen condition. In summer a large carcass must be either processed by salting and curing or by putting a large part of it in cold storage. The cold-storage locker system, now widely in use, makes it possible to provide storage the year around at low cost. Where lockers are not available, some farm communities meet the problem by forming a meat ring. Then, when a heavy animal is dressed, the carcass is divided up among the members in quantities that each family can use before spoilage occurs. Adjustments are made for differences in weights of cuts and quality of meat.

The smaller animals, such as hogs, calves, and sheep, are best suited for the small family or for summer use, as the carcasses are small and can be used before spoiling. Mutton and veal are not so popular with farmers as pork. Hogs, therefore, supply the larger part of the meat used by farm families either in the fresh or the cured form.

Poultry Products. Poultry and eggs are much more commonly used by farm families than other food products. There are few farms in the United States which do not have at least a small flock of chickens or other poultry. Eggs have many advantages as a home-raised food. By good management they can be produced every day in the year. They take no processing, other than cooking, and can be kept for considerable periods of time without spoiling. Eggs are nutritious and highly nitrogenous and, therefore, well calculated to supply tissue-building nutrients to the muscles. Their value as a farm food should not be overlooked.

Although not served so frequently, poultry meat is also universally a farm food. The poultry meat unit is small and well adapted to small families. Even during the heat of summer the meat can all be used before spoilage occurs. It is for this reason that chickens, particularly, furnish most of the fresh meat used by farm families during the summer season.

Another point in favor of poultry is that the average farm flock lives on what would otherwise be waste. Refuse grain, table

scraps, skimmed milk, and other farm products, are excellent poultry feed and may well be utilized as such as a matter of good economy.

The poultry enterprise is especially adapted to the small farm. A flock of one hundred chickens will require about the same space and about the same quantity of feed as one cow. They are more easily housed and cared for and do not require the roughage rations required by cows. The poultry enterprise deserves a prominent place even on the small farm.

AMOUNTS OF FOOD USED

The problem of farm-raised foods for the family is sufficiently important to justify an examination of the experience of farm families. In a report from the University of Illinois, as given by Hudelson[1] records from 57 farms over a period of ten years, 1925 to 1934, the wholesale value of home supplies was shown to be $368.00 per farm family. Hudelson estimates that the cost of these supplies purchased at retail would have been $767.00. The saving to each family of approximately $400.00 is an item of real significance to the farm operator.

There is a wide variation in the quantities of farm-produced foods used by farm families in different sections of the country. There is variation also in the classes of food used. This variation is determined largely by the nature of the crops and livestock produced. In the fruit and cotton-producing areas the use of dairy products and meat is much more limited than in areas of diversified and livestock farming. Data of interest in this connection is presented in Table LVI, which shows the amounts of the staple farm products used by farm families in ten states. Similar data for Minnesota farm families are given in Table LVII.

QUALITY OF FARM FOODS

The quality of foods used by farm families may be of the best. There is a distinct advantage in being able to use them when at just the right stage of maturity to be most palatable and nutritious. Those who have enjoyed the privilege of eating tree and vine-ripened fruits are quick to detect the lack of flavor and quality in fruits picked green and ripened in transit. Strawberries, fully ripened, and fresh from the vines are much superior to the same variety picked early and shipped to a central market. Sweet corn, gathered when at just the right stage, and cooked

[1] R. R. Hudelson, *Farm Management*, p. 240.

TABLE LVI—FARM-FURNISHED FOOD FOR HOME USE: THE AVERAGE SUPPLY FOR A HOUSEHOLD* FOR A YEAR IN AREAS REPRESENTING DIFFERENT TYPES OF FARMING, 1935-1936[1]

Selected Counties in	Type of Farming Represented	Families Included	Average Quantities or Money Value of Food Produced for Home Consumption								
			Milk	Eggs	Poultry	Pork	Other Meat	Potatoes	Other Food from Garden	Fruits	Other Food†
		No.	Gal.	Doz.	No.	Lb.	Lb.	Bu.	Dol.	Dol.	Dol.
Vermont	Dairy	513	326	124	17	139	112	42	43	4	7
Ohio	General	814	212	146	36	440	155	23	38	15	5
Illinois	Corn or cash grain	838	248	160	68	637	148	12	22	4	‡
Kansas	Wheat or cash grain	557	264	1	97	328	159	2	10	‡	‡
Colorado, Montana, South Dakota	Range livestock and cash grain	794	281	178	55	290	296	19	43	7	3
Oregon	General and fruit	1,611	251	138	35	195	119	14	45	23	1
Southern California	Fruit and nut	1,080	93	74	20	8	11	1	6	11	‡
South Carolina:											
White	Cotton and tobacco	2,048	287	113	64	659	12	7	51	8	23
Negro		478	158	59	36	363	5	4	32	4	30

* Non-relief families of farm operators, including husband and wife, both native born, 0-8 other family members, and household farm help.

† Includes syrup, molasses, honey, grain products, and cowpeas and other foods grown in fields.

‡ $0.50 or less.

[1] From *Yearbook, U. S. D. A.*, 1939, p. 316.

at once, is far more tender and palatable than that which is held in storage for even a day or two. Tomatoes, fully ripened on the vine, are much more attractive than the green tinged, pale pink ones so often found on city markets. The same arguments apply equally well to the vegetable and animal products that go to

TABLE LVII—AVERAGE QUANTITY OF FARM PRODUCE USED PER FARM HOME IN MINNESOTA[1]

Item	Winona County 1935-40	14 S. E. Counties 1935-40	13 S. W Counties 1940-44	9 N. W. Counties 1940-43
Whole milk, qts.	1,492	1,297	1,115	813
Skim milk, qts.	137	195	386	604
Cream, pts.	299	262	264	452
Farm-made butter, lbs.*	1	4	11	39
Eggs, doz.	212	192	187	119
Poultry, lb.	190	149	115	104
Cattle, lbs.†	281	356	430	344
Hogs, lbs.†	823	528	552	518
Sheep, lbs.	2	10	9	17
Potatoes, bu.	34	23	15	26
Wood, cords	13	7	....	7

* Because of the widespread prevalence of co-operative creameries over the state of Minnesota, few farmers make butter. The cream is sent to the creamery where the butter is made and butter is returned for the use of the farm family, where it becomes an item of cash expense.
† Live weight.

balance the family diet. Fresh milk and cream in abundance can be made available to most farm families. These, with fresh eggs and poultry supplementing the fruits and vegetables, will supply adequately all needs for building and maintaining the human body and for insuring its healthful functioning. To these may be added the meat products from one or more of the classes of animals kept on farms where the production program is well diversified. On such farms there is no justifiable reason for scanty food or an unbalanced diet for the farm family.

PREPARATION AND STORAGE

The average farmer is more concerned with the preparation of food for his own use than for sale. Vegetables, root crops, and all foods stored in their original state should be carefully harvested, so as to avoid bruises and cuts. Surplus dirt should be removed and the product stored in a cool basement or root cellar. Ventilation should be adapted to provide air and moisture control. Every home should have a storage area for this purpose.

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[1] *Farm Business Notes.* University Farm, St. Paul, No. 196, April, 1939.

Root crops may be stored in sand or coarse soil to preserve moisture and crispness. Cabbage heads may be wrapped in newspaper and kept in a cool place. Squash and pumpkins may be kept for a long time, if placed in a moderately cool, dry room. Apples and potatoes should be stored in specially prepared bins where the temperature is low but above freezing and the air somewhat moist. Careful checking occasionally to remove the decaying specimens is advisable so as to prevent the decay from spreading.

Preserving vegetables and fruits by canning is a common practice on most farms. The thrifty housewife plans for the winter months ahead by preserving as much food as will be needed. An estimate should be made of the food needed for family use and a proportionate amount for canning. It is not economical to can much more food than is needed simply because an abundant supply is available. Too often, if more than is needed is canned, spoilage occurs before the food can be used. Emphasis should be placed on fruits and those vegetables which are relatively scarce during the winter. Green apple sauce, properly canned, will aid greatly in planning the menu during winter months.

ANIMAL FEEDS

The advisability of providing generous supplies of farm-grown feeds for the livestock produced has already been stressed. The organization plan of every farm should be shaped to supply the feed needs of the animals kept and to supply power and productive ability. That plan must be revised and adjusted by the operator to provide the year-by-year need for feeds. It becomes important, therefore, to give further attention to the kinds of feeds used and to the quantities in which they will be needed. They may be classified into four major groups: (1) pastures, (2) forage crops, (3) silage and root crops, (4) concentrates. Location of farm, soil type, topography, and the number and kinds of livestock kept should determine the proportions in which these feed crops should be grown.

Pastures. Good pasturage crops are the foundation of economical livestock production. Grasses and legumes are the natural feed crops for nearly all classes of domestic animals. When cattle, sheep, and horses have free access to good pastures they make good growth and gain in weight or production. On such feed they need but little care or attention other than to see that fences are in safe order and that pure water is easily available. Because livestock can be cared for on good pasture crops with the least

labor and at the same time do its best in the conversion of feed into milk, meat, or other product, the pasture season should be made as long as possible. To provide good pasturage over a season of 180 to 220 days will require foresighted planning and good management.

Kentucky bluegrass, timothy, and the native grasses of the prairies provide the permanent grass pastures of the North. Bermuda grass, Johnson grass, lespedeza, and native grasses are the principal pasture grasses of the South. These, like most other crops, are seasonal in growth and must be kept under control to get the best results for their use. The pasture grasses of the North start slowly in the spring and go into a resting period during the hot days of late summer. Earlier spring pasturage of good quality can be provided by sowing the fall previous a reasonable acreage of fall rye or rye and winter wheat mixed. In the South winter barley and winter oats, combined with winter wheat, furnish much winter pasture. If sown in the early fall, late August, or early September, the crop will provide some late fall feed and also early spring pasturage. Use of such annual crop pasturage until late May or early June will give the grass pastures a chance to make good growth before livestock is turned on, thus giving protection to the plant roots and prolonging the period of growth.

Dividing the grass pastures into two or more fields and rotating the periods of pasturing is becoming a modern farm practice. In this way overgrazing is avoided and greater total production is secured. Less effort is required by the animals also in getting a full feed, and a larger proportional return of body weight or of other product results. Feed used in creating energy for transporting the body can not be used for the manufacture of milk or meat.

Top-dressing the permanent pastures with manure or with commercial fertilizers will in many instances result in better yields. Disking a portion of the pasture land lightly in early fall and applying a dressing of barnyard manure will increase the pasturage materially the next summer.

There is a growing tendency among farmers to combine alfalfa, biennial sweet clover, and other legumes with the grasses for pasture purposes. There is much to be said in favor of such practice. The legumes add bulk to the pasturage and improve the quality of the ration. They also add to the nitrogen of the soil through the bacteria living in association with the alfalfa roots and stimulate the growth of the grasses. Prejudice against the

legumes as pasture crops, because of supposed danger from bloat, is being overcome by experience and good pasture management.

Because grass pastures are usually bare and short in midsummer, supplementary pasture crops are often advisable. Sudan grass is widely used in the North for this purpose. Lespedeza, soybeans, and other annual crops are used in the South and Central states. Mixtures of the cereals and Dwarf Essex rape are particularly useful as pasture crops for swine, sheep, and poultry.

FORAGE CROPS. Second only to good pastures in economy of livestock production is an abundance of high-quality roughage. The ruminants, and horses, particularly, can and do utilize much cheap, bulky feed. This is usually supplied in the form of cured hay from grass and legume crops. Corn fodder, Sudan grass, the saccharine and nonsaccharine sorghums, and even the cereal crops are at times and in some places also used as cured forages for livestock feeding. There are wide differences in the quality of the nutrients furnished in these forages and in the quantities yielded per acre of land. The legume hays made from alfalfa, soybeans, red and alsike clover rank high in total digestible nutrients as may be seen by reference to Table LVIII. They also rank high in digestible protein which tends to reduce the quantity of high protein concentrates required to balance the ration. For these reasons and because large yields per acre can normally be grown, they should be given first consideration in the forage supplies. Corn for cured fodder, for grain, or for silage also merits a large place in the forage supplies. Less labor is required in growing the legume hay crops than in growing corn, and, where good yields can be secured, legumes should be given preference.

AMOUNTS REQUIRED. The amounts of forage crops grown on any farm will depend upon the kinds and number of livestock kept. The average amounts required annually by different animals are given in Table XXI, Chapter XIV. In making plans for feed, one should remember that it is better to have a reasonable surplus than to run short of supplies.

SILAGE AND ROOT CROPS. One of the chief advantages of the grass crops in summer feeding lies in their succulence, or soft, juicy, easily digestible substance. To supply such feeds in the winter season is somewhat difficult. To meet this difficulty many farmers have built silos in which to preserve forage crops in green and succulent form. This succulent feed is fed to livestock during the winter months largely to supply the place filled by the pasture crops during the summer season. Ensilage is especially

popular with dairy farmers, because it enables them to maintain their cows in high production during the winter months, when

TABLE LVIII—AVERAGE AMOUNTS OF TOTAL DIGESTIBLE NUTRIENTS IN 100 POUNDS OF COMMON ROUGHAGES[1]

Kind of Feed	Digestible Protein	Total Digestible Nutrients
Dry Roughage	Lbs.	Lbs.
Alfalfa hay:		
Early cut	11.6	51.4
Medium early cut	10.4	51.5
Late cut	9.6	48.7
Soybean hay	7.9	50.0
Sweet clover hay	10.9	50.7
Red clover hay	7.4	49.6
Alsike clover hay	7.9	47.3
Mixed hay (½ clover, ½ timothy)	5.1	49.3
Reed canary grass hay	4.5	52.3
Sudan grass hay	3.7	51.4
Timothy hay	2.9	48.0
Prairie hay	2.8	48.3
Oats hay	4.7	45.5
Corn fodder	3.7	48.1
Oat straw	1.0	45 6
Corn stover	2.0	36.4
Wheat straw	0.7	36.9
Succulent Feeds and Miscellaneous	Lbs.	Lbs.
Corn silage	1.2	16.8
Sunflower silage	1.0	13 7
Corn cannery silage	1.1	17.8
Pea cannery silage	2.8	15.3
Potatoes	1.1	17 3
Sugar beets	1.3	11 5
Mangels	1.0	6 5
Rutabagas	1.0	9 5
Skimmed milk	3.5	8.7
Whole milk	3.3	16

milk and butterfat prices are highest. Corn is the most common and most popular ensilage crop, though many other crops may be so utilized. The sorghums, sunflowers, and other rank-growing forage crops are sometimes used. The legume and grass crops can be successfully ensiled by the addition at silo-filling time of molasses or other quickly reacting carbohydrate to start the fermentation process. The preservation of legume crops in this manner is rapidly gaining popularity.

Contrary to the common belief, ensilage is a relatively high-cost feed. The labor of growing the crop, coupled with the cost of

[1] Compiled from Table V, *Bulletin 218*, Minnesota Experiment Station.

erecting a suitable silo, the power, and the cost for machinery and labor needed for filling the silo make the cost high. To offset this, however, is the saving of nearly all the crop without loss, convenience of feeding, and, usually, increased production.

The silo is of doubtful economy on farms where small herds are kept. On farms where large herds of cattle are kept and where high production is desired, the silo undoubtedly has a place.

On small farms and in areas where the growing season is cool and short, root crops make a welcome addition to the feeding rations. Roots are high in water content and take the same place as silage in supplying succulence in the ration. Roots such as mangels, sugar beets, rutabagas, carrots, and turnips, when properly sliced or chopped, are much relished by cattle, in particular. Considerable labor is required to grow them and they must be stored where they will be safe from frost. Their principal place is for late fall and early winter feeding. If silage is not available, a supply of roots is a good substitute.

Concentrates. Because concentrates are more nearly in the foods class than grasses and forage crops, they are relatively higher in price. In livestock production it is good economy to make all the growth possible on the cheaper feeds. Concentrates should be supplied of the kinds and quantities best calculated to supplement the nutrients contained in the available roughages. Corn, grain, sorghums, oats, barley, and other coarse grains can easily be produced on most farms in connection with livestock. Corn will supply the most feed, is most popular and palatable, and the most widely adapted for feeding purposes. It is also easily and cheaply stored for use. The coarse grains and corn should form the bulk of the concentrates in the feeding ration. Unless these can be produced in profusion on a farm, livestock production is not likely to prove a profitable venture. The purchase of concentrates should be limited to high protein feeds such as oil meal, cottonseed meal, tankage, and to such minerals as may be lacking in the feeds produced on the farm.

CHAPTER XXVII

FARM MARKETING PROBLEMS [1]

Modern agriculture has become exceedingly complex. Less than one third of the population of the United States is engaged in agricultural production. Those so engaged must produce the elementary food and clothing, not only for themselves, but for those who do not live on farms, as well. They in turn require various forms of goods produced by those living in towns, cities, or elsewhere and not engaged in farming. The foodstuffs and other commodities produced must often be assembled, sorted, graded, processed, packaged, stored, and transported long distances before being distributed among buyers and consumers. The exchange of commodities between producers and consumers has resulted in establishing local and terminal markets for the distribution and exchange of goods. The problem of getting the products of the farm into the possession of the consumer has become so complex that, on many important products, only one fourth to one third of what the consumer pays for the product goes to the farmer who produced it. The balance is divided between transportation charges, commission men, jobbers, wholesalers, retailers, or others who contribute something to putting the goods in final form and condition before they reach the consumer. Production is and always will be the major function of farmers. They will be wise, however, to give serious study to marketing problems, in order to know that they are getting full value for their products. Efficient marketing service greatly influences the profits from farming.

HANDICAPS IN FARM MARKETING

Only a few farmers have facilities for marketing their products in the most efficient way. As a rule, sales are made on a local market by the individual farmer when he has something ready to sell. At times, if he is in urgent need of money, he often

[1] A full discussion of marketing activities as related to farming, together with an explanation of the technical organization of marketing institutions both private and co-operative, will be found in Chapter XXX. The discussion in this chapter relates only to the marketing problems farmers meet in disposing of the products raised or in buying supplies.

sells at a sacrifice. Whatever he has to offer is placed at the nearest local or terminal market and the seller takes what he can get for it. The individual farmer acting alone has but little influence on the market. He does not have enough of any product to affect demand one way or the other. Seldom is there enough of a product from one farm to ship in large lots or carloads to a better market. The seller in such cases has no other recourse than to take what the local market man is willing to pay. If the seller knows the value of his product and is good at driving a bargain, he may get all it is worth on that market.

Good products marketed in small lots on the same market with poorer products are used by the buyer to bring up the average of a lot or carload when sold. The seller of good products on such markets is likely to get less than full value and the seller of poorer quality products may get more than full value for his. Where only staple products, which are graded and imperishable, are to be marketed the problem is not so serious. But, if the product is perishable or valuable and must be marketed as a specialty, business ability in selling is one of the most essential qualifications of a farm manager.

STEPS IN THE PROCESS OF MARKETING

Marketing is not a continuous everyday matter with farmers. Some kinds of products, like milk or cream or berries in season, may be taken to market daily. Most commodities, however, are seasonal and are offered on the market at irregular times. To get the best possible prices for such commodities, plans must be made ahead of time and preparations for marketing developed.

Study the Market Reports. To sell goods successfully and at a profit one must be familiar with probable supplies of the commodities to be offered for sale and the demand likely to be made for them on the domestic and world market. Fortunately, there is now established in the United States Department of Agriculture a comprehensive and reliable crop and livestock reporting service that will supply without charge much information on these questions. The Department also publishes at frequent intervals for free distribution Outlook Reports that give much statistical data on the prospective production and movement of the principal agricultural products. Price ranges are given and charts are supplied that show trends and cycles in both production and prices. One wishing to keep informed on market conditions should ask the United States Department of Agriculture

for the Outlook Reports as issued, and particularly for the reports on the commodities he is producing. Because of the great volume of production in the United States and the wide variety of commodities produced these reports cover many more than are of interest to any one farmer. From the information offered one may select that which applies to his own need. Much information of value is contained in *Crops and Markets,* a monthly journal, also published by the Department. A brief summary of general agricultural conditions is published monthly as "The Agricultural Situation." It gives timely advice on important commodities and on the general conditions prevailing that influence market outlets and prices. It will be mailed by the Department to anyone desiring it at a subscription price of fifty cents a year.

Market news is given by radio service also and often enables one to take advantage of short-time fluctuations in putting livestock or other products on a near-by market. Those who are willing to make the necessary effort to learn about market conditions will find abundant information available to them in reliable government publications. Judgment and decision must be used, however, in applying the information to local situations.

WHEN IS THE TIME TO SELL? The obvious answer is to say, sell when the product is ready and a good price can be obtained. But having the product ready at a time when good prices can be obtained is not always possible. Some products, such as grain, corn, hay, and processed products, can be held for a considerable time under good storage conditions; but storage is attended by risk of loss from weather, fire, and vermin. If stored for some time, insurance should be carried, which adds to the expense. There is always a chance, too, that the expected price improvement will not be realized. Expense, too, has been added to marketing the product and can not be recovered. Loss of flavor and quality is experienced also, if products are stored too long.

(Most products from the farm sell best when fresh.) Few farms have facilities for storing fruits, berries, or other quickly perishable products in quantity. Apples can be held for a time; but, as a rule, they are sold as harvested. The fruits can be kept in cold storage, if such facilities are available; but, again, that storage adds to the expense and does not always insure better prices.

Cattle, hogs, sheep, and poultry, to be sold for meat purposes, can not profitably be carried for any great length of time after they have reached the finished form. The rate of gains made from feed consumed declines as high finish is reached and the

cost per pound of gain rises. Animals can be profitably carried for a few days and sometimes for a month or two past the prime finish, when market conditions are improving; but, usually, it is best to sell when they have reached the weight and form required by the market. The skill and judgment of the operator should be used in determining when to start the animals on feed and in bringing them to marketable form at a favorable time rather than in trying to carry them after they have reached satisfactory finished form.

The products of the dairy are sold from most farms in the form of whole milk, cream, or butterfat. To sell well in any of these forms the product must be clean, fresh, and sweet. Few farmers have facilities for keeping it in cold storage. It must, therefore, be delivered daily at a creamery or other marketing point. There is little opportunity to gain marketing advantage for these products by holding or storing them on farms. When milk is converted into butter or cheese, the products can be held indefinitely in suitable cold storage plants. Large quantities of butter, cheese, and eggs are bought by speculators when prices are low and held by them until a favorable market insures a profit. Such operations influence the prices farmers receive for milk, butterfat, and eggs, but are not under their control.

There are always questions as to when and where to market finished products that are ready to be sold. Some farmers favorably located and on good roads can get radio market reports and truck their products to market on short notice when prices are favorable. Others must ship when ready and hope to reach the market at a favorable time. The best opportunities for most farmers to market at a favorable time lie in following long-time forecasts of supply and demand offered by the government reports. One can not always interpret these forecasts correctly, but individuals who give close study to them will, over a period of years, make fewer mistakes in marketing. Products should be produced on the promise of prospective prices when the product will be ready to sell rather than on the prices prevailing when the plans are made. The farm operator will do well to remember that in these days of quick transportation local supplies do not determine the prices paid at the local market. That fact is one of the chief reasons for keeping informed on probable supply and demand in the United States and world markets. Well-planned and well-timed production yields the best returns for labor and materials used.

How to Market. Whether farm products should be retailed direct to the consumer or sold through a commission or marketing agency will depend on local conditions. The real question is whether or not the farmer can earn more for the time spent in selling than he can for the same time spent in producing more product. Usually farmers are so fully occupied in growing and preparing their products for market that it is best to leave the distribution to other agencies. When the products from many farmers can be combined in one distributing agency, cost of distribution can be greatly reduced. Those operating such agencies are often better informed and more skillful in placing the products than those who produce them. Better prices, therefore, are obtained and paid by them than the farmer would realize were he to undertake their distribution himself.

Roadside Markets. Roadside markets are a relatively new development in the marketing field. That not all roadside markets are successful is plainly evident to anyone who travels the highways and will observe. Facilities for offering the goods range all the way from hand carts, rusty automobiles or trucks, to well-arranged, fully-equipped merchandising establishments with curb service. These often have cold storage plants for preserving the perishable products until they can be sold. Such roadside markets are usually located just outside of large centers of population where a large volume of business can be done. Farmers on near-by farms often dispose of their products at such markets, but do not deal directly with the buyers.

Less pretentious roadside markets sometimes are set up for seasonal operation by farmers located on a main highway. These markets are open only at such times as there are products of good quality in abundance for sale. Berries, melons, apples, grapes, and other fruits find ready sale when well graded and attractively packaged. Buyers will pay approximately the retail price charged at the nearest city markets. Eggs, poultry, milk, cream, and honey are other products that often can be sold to advantage at such markets. The gain in prices received for goods sold must be sufficient to pay for the time of the attendant who gives the service. Roadside markets can not be given a blanket endorsement. Many of them tell their own story of disillusionment by rusty signs, and dilapidated housing or abandonment.

Good location, attractive display of high-quality products, fair prices, steady and reliable supply, prompt service and attention to customers are among the essentials for a successful ven-

ture. Easy access and "a place to park" are important features of the roadside market.

Quality Commands a Premium. Much can be gained in market prices for farm products by careful preparation and finishing of the goods or article to be sold. Grain containing weed seeds, dirt, and foreign matter must be cleaned before it can be used. If the buyer must clean it, he must buy at a figure low enough to pay for the cleaning. The seeds and foreign matter may have value as livestock feed. Were the farmer to clean it, he would not only get a better price for the grain he sells, but could retain the screenings for feeding purposes. The aim should be to produce clean grain, free from weeds and of good quality, for which a premium can be demanded. If produced in sufficient quantity, shipment to a terminal market can be made when the local market refuses a satisfactory price.

The special preparation of certain articles of produce deserves careful consideration. Most markets pay a good premium on freshly-gathered eggs. If eggs are gathered daily, well cleaned, marketed with the date on which gathered, and shipped promptly in cartons, a much better price can be obtained than if sold unpacked or traded to the local grocer. By adopting a trade-mark or trade-name and paying attention to the demands of the purchaser a fancier price can sometimes be secured. It is not unusual for farmers to obtain a premium of from two to five cents, or more, a dozen on high-quality eggs attractively presented to the consumer.

Butter, hams, bacon, poultry and other articles of produce can be sold at an advance over the regular market, if they are of high quality and prepared in an attractive way and offered in a reasonably constant supply. The labor required for the preparation of such articles for market may be well repaid if wisely expended. One must avoid fussing over them so much as to raise the labor costs beyond the possible extra margin in price. To sell promptly, the goods must be attractive.

One of the essential points in establishing a special market is to provide a regular supply. Nothing is more fatal to a fancy trade among special customers than disappointments in not receiving either the expected quality of goods or the expected supply. Attention to regular deliveries and to furnishing products that are always up to the trade-mark standard is essential to success in catering to a special market.

Study given to the style of package that best pleases cus-

tomers is well worth while. The size of the package in which the special products are to be marketed should be given thought. It must be shaped to conform with the transportation facilities available and to put the article before the customer in good condition. Plums, grapes, tomatoes, and other soft fruits and vegetables carry best in small packages. They also sell best in such packages at retail prices. Sorting, grading, and labeling of all fruits and most vegetables will help to secure good market prices. In fact, sorting and grading are important factors in the preparation and selling of most farm commodities.

In selling livestock it is important to have the animals in good condition at the time of sale. Animals in good flesh and clean always sell better than those in thin flesh and poorly cared for. Dairy cows sell best with their second or third calf. Brood sows ready for the second litter of pigs are the most valuable, if in sound condition. Yearling and two-year-old ewes will bring the best prices. Most stock sold for meat should be sold at the weights and ages demanded by the markets when it can be finished profitably to that point.

MARKETING CO-OPERATIVELY

Reference has been made to the fact that most farmers produce relatively small quantities of many products which they themselves can not market to good advantage. They also buy in small quantities and often at a disadvantage in price. One of the discouraging features in farming may be said to be that the farmer, acting individually, is under the necessity of selling at wholesale and buying at retail. Attempts to remedy this situation through co-operative buying and selling have opened to many farmers opportunities to improve the net income from their farms.

Advantages in Co-operative Selling. One of the chief advantages in co-operative selling lies in assembling in one place large quantities of a product. When assembled, it can more readily be prepared or conditioned. Because there is enough for full trucks or carloads, transportation costs are less per unit of product. Markets for full carloads are available which could not be utilized in marketing small lots. A capable manager of a co-operative marketing agency is likely to keep more fully informed on market conditions than the farmer operating alone, unless he is a large-scale producer. Handling the product in large bulk often gives the seller an advantage in bargaining power which will

result in better prices. Not all co-operative selling organizations succeed. There are records of many failures. Enough have succeeded under good management to demonstrate their value as marketing channels for farm products. Co-operative creameries, cheese factories, grain elevators, and livestock shipping associations have been among the most successful of the co-operative selling agencies. Farmers should make contact with local co-operative agencies and learn the advantages offered through membership.

ADVANTAGES IN CO-OPERATIVE BUYING ASSOCIATIONS. There are also opportunities for gain in buying in large quantities. Farmers, acting alone, are usually forced to buy in small quantities and at high prices. By combining orders with neighbors wanting a quantity of the same products a truckload or a carload may be purchased at a price reduction. There will be saving in transportation costs also. Buying organizations have been set up by farmers in many states for the purpose of buying in quantity for redistribution among the members. The Grange League Federation of the eastern states has been highly successful in the purchase and distribution of dairy-cow and poultry feeds at favorable prices. These are processed, when necessary, repackaged, and distributed among the members at a cost materially lower than they could be purchased in small lots by individuals. The State Farm Bureau Federations perform a similar service for Farm Bureau members in the purchase and distribution of grass seeds, fertilizers, machinery, and other materials. The Farmers Union marketing organizations also assist their members in securing favorable prices on tractors and other heavy machines and implements, in buying oil and gasoline, and many other commodities. Land O'Lakes Creameries, which was organized as a selling agency, now serves also as a buying agency for its members. Land O'Lakes Creameries is a federation of farmers' co-operative creameries, located over a wide area of the dairy region. These are brought into a federation with a central headquarters from which the main selling and buying activities are conducted. Creamery and dairy equipment, dairy and poultry feeds, fertilizers, and many other supplies used by farmers and dairymen can be purchased through the organization at favorable rates.

The co-operative organizations named are only a few of many such organizations spread over the United States. They assist the farmers in their marketing problems. Fruit-growing co-operatives on the West Coast, tobacco-growing co-operatives in the

tobacco-growing regions, and many other forms will be found that are giving service in either selling farm products or buying supplies for farmers.

Farm operators should make it a point to become acquainted with local co-operative agencies and make use of the facilities offered by them when such procedure promises better returns for the products to be sold.

Co-operative Marketing Increasing. There has been greatly increased activity in co-operative marketing in recent years. Local co-operative marketing associations of one kind or another have been organized in large numbers to handle many of the staple products. In some cases material gains have been made in so doing. In other cases the gains have been negligible or loss has resulted. These experiences indicate that farmers will do well to give consideration to marketing co-operatively whenever the prevailing private marketing system is unsatisfactory. Efficient co-operative marketing must be built upon well-founded and loyally-supported locals. When these local associations have been properly organized and able leadership has been provided, it may be possible for these locals to be associated in still larger marketing associations to advantage. The organization of local livestock shipping associations into state associations and of local co-operative creameries into district, state, and federated associations, are examples of what may be done under able management. The advantages from such associations lie in the possibilities of standardizing the goods, in improving the quality, in shipping in larger quantities, and in stabilizing the market to a greater or less extent.

Co-operative marketing should not be regarded as a panacea for all the evils that have crept into private marketing systems. It can be of value only when it supplies the same service for less expense or better service for the same expense. If a co-operative marketing organization is to succeed, it must have (1) a sufficient volume of business to employ capable management and the necessary facilities, (2) business management at least as good as that found in private marketing, (3) accurate accounting on which to build good business practices, (4) sufficient capital to provide the necessary facilities for operating and for conditioning the products, and (5) a loyal membership that will maintain a constant volume of business. In short, it must furnish better and more economical marketing service than that furnished by the system it displaces or with which it competes.

✓ CHAPTER XXVIII

USEFUL FARM RECORDS [1]

Records of past experience are among the most valuable guides for farm business management. Unfortunately, farmers have had fewer accounting records to guide their operations than the proprietors of any other important type of business. Farming in America is characteristically a family business, composed of a large number of small units. The business of the individual farmer is too small to justify the employment of a trained bookkeeper. If a farmer wants records he must, in most cases, keep them himself. He is not trained in accounting, and the routine operation of the farm absorbs his time and energy. However, small though the individual farm unit may be, farming is a highly complex business and adequate records are essential to successful management. It is impossible for anyone to remember all the detailed information about the business that a farm manager needs. Most farmers keep some records but, generally speaking, the information contained in them is incomplete and inadequate. Good records are the first essential for good farming.

USES OF FARM RECORDS

The following are some of the important uses served by farm records:

1. They provide a record of financial transactions and earnings.
2. They indicate the financial condition of the farmer and his financial progress from year to year.
3. They serve as a basis for studying the farm business and for planning improvements.
4. They supply the basic information for a sound credit policy.
5. They provide a memorandum of farm transactions and farm practices and performance for future reference.
6. They aid in preparing an income tax return.

[1] No attempt is made in this chapter to present detailed instructions for keeping or analyzing farm records. The aim is rather to point out important factors to be considered by the farm manager in selecting the records to be kept and in using them to best advantage.

Most of these uses have been discussed in previous chapters. They have long been recognized and understood. In recent years government programs for agriculture have shown the need for more information on past production and practices. The increase in farm income during the war period and the application of federal and state income taxes to lower levels of income have brought to the majority of farmers the need for adequate accounting records of farm income and expense. With these new factors in the picture, as well as the growing importance of management as a factor in successful farming, farmers are coming to realize the importance of keeping more and better farm records.

KINDS OF FARM RECORDS

FARM INVENTORIES. The starting point of any system of records is a complete inventory of assets and liabilities.[1] In farming it is important that the inventory be fully itemized, with adequate description of each item. It is as essential to list physical quantities as to record monetary values. Because of its usefulness for income tax purposes it is best to set up a depreciation schedule for machinery, buildings, and similar items of depreciable property. Once this is set up, it is easy to compute values in succeeding years. Current market prices are generally used as a basis for the valuation of other items. Inventories are taken at the beginning of each business year. The inventory serves as a basis for determining net worth and financial progress and is needed in the computation of earnings, since the farm business with a large amount of capital relative to annual income lends itself best to the accrual method of accounting. The inventory is also a valuable memorandum of facts about the farm property.

CASH RECEIPTS AND CASH EXPENSES. A record of cash receipts and expenditures is essential in any business. It is highly important that a full description and itemization by quantity be noted, as well as prices for all sales and purchases. This information is needed for checking and analyzing the record. If the amounts of money received or paid out are recorded without descriptions, the cash account will have a limited value to the farmer. A record of personal receipts from sources other than the farm business and of personal and household expenses should be kept by the farmer. Much confusion can be avoided if these items are recorded in a separate record or a special section of the

[1] See Tables XXX and XXXI, Chapter XIX.

farm account book so as to be distinguished clearly from farm receipts and expenses. There are also items of joint expense that cover both farm and personal use, such as expense for the car or for electricity. Time may often be saved by entering these items currently in the farm record, breaking down the total at the end of the year, and deducting the personal share.

PRODUCTION RECORDS. All farmers should keep a record of acreage, production, and yield per acre of crops each year. This is not only valuable from a management standpoint but may be very useful in connection with government programs for agriculture. A record of livestock production is also necessary for an analysis of the livestock enterprises. In the case of dairy cattle, dairy-herd improvement associations may be employed to record dairy production. A very useful approximation of dairy production may be secured if the farmer itemizes his receipts from dairy products by quantities and also records the milk used in the house and that fed to livestock. Egg production may be recorded daily, or the total for the year may be computed from itemized sales and records of home consumption. Very little additional work is needed to secure production records if sales, expenses, and inventories are carefully itemized.

FEED RECORDS. Feed records are essential to an effective analysis of the livestock enterprises. They provide valuable information for budgeting purposes. A reasonable approximation of feed consumption by the different classes of stock may be obtained without weighing out all feeds as fed. By feeding one kind of livestock from one bin, crib, or mow it is possible to get bulk quantities with little effort. Where this is impracticable, occasional estimates of daily feeds may be used as a basis for computing total consumption. By checking the total quantities of feed reported as used against sales, purchases, yields, and inventories, it is possible to detect errors of estimate and to correct the feed reports.

LABOR RECORDS. Labor is a very important item of cost in farm production. However, it takes a great deal of time to make a daily record of labor use by enterprises and much more to summarize and analyze these records at the end of the year. The records may bring out information of considerable value to the farm manager, but the time required is so great that few farmers find it worth while to keep complete labor records. They have an important place in farm management research, but the average farmer can analyze his labor efficiency fairly well without them.

What information he needs for budgets he can supply satisfactorily by estimates or from the results of research studies of labor requirements as published by state experiment stations.

Record of Farm Produce Used in the House. Most farmers get a substantial portion of their food from products raised on the farm. A record of products so used is essential to a complete statement of farm income and of farm production. It is not essential, however, that each item be recorded as consumed. Occasional estimates serve as a basis for a reasonably complete statement of the contribution of the farm to the family living.

Miscellaneous Farm Records. Other records that may be useful to the farm manager include breeding records, crop and livestock practice records, seed records, manure, fertilizer, and lime use records, planting and harvest date records, and reports of current changes in livestock numbers. All of these serve a useful purpose, and, for certain types of farming, any one or all of them may be essential. Since keeping all these records requires time, and the farmer has a variety of tasks demanding attention, he finds it necessary to eliminate many of the types of records, even though they would be useful and interesting, and to confine his energies to those that have the most direct value to him.

FARM RECORD BOOKS

Farm records are kept in a wide variety of books and forms. Some farmers use a regular farm account book, some a simple notebook, and some merely note their figures down on the calendar. The records of some farmers consist only of an envelope or box containing cancelled checks and sales slips, while those of others consist of a few figures on the granary door or the side of the feed bin. A good record form should be so arranged that it will contain all the information required, and that entries can be made in it and information secured from it with the least expenditure of time and effort. The characteristics of a good farm record book include the following:

1. It must be simple and easily understood.
2. There must be suitable forms for entering the types of information the farmer wishes to record.
3. There should be provision for an itemization and classification of all entries. The classification should bring like items together so that it is easy to study and check the record and to analyze it at the end of the year without having to re-group or re-copy the items.

4. There should be adequate space for itemizing all entries, and the lines and spaces should be sufficiently large for writing without crowding.
5. There must be ample space in each section for all the entries that are likely to be needed.
6. There must be clear and adequate instructions, but they must be sufficiently brief and to the point so that the farmer will read them.

CASH ACCOUNT

Date	Item and Description	Received	Paid Out

Figure 32. Sample of Simple Memorandum Cash Record. This type of record is easy to keep but difficult to use in studying the farm business because all entries must later be sorted and reassembled.

In most states extension and research workers in farm management have prepared farm account books suitable for use by farmers of the state. Since these books are based on years of experience in helping farmers with their accounting problems and have been revised from time to time in the light of this experience, they are likely to prove more satisfactory than a system of records devised by the farmer himself. These account books are usually for sale at a moderate price. They are carefully planned and will save the farmer so much time in making his entries and analyzing his records that he can scarcely afford to experiment with a makeshift system even if the cost is less.

Single or Double-Entry Accounts. There are two general types of farm record books, the single-entry and the double-entry. For most types of business the double-entry is to be preferred because of the greater accuracy. Since it requires some knowledge of bookkeeping principles, it is not well adapted to general use by farmers. A record of physical quantities, in addition to one of cash receipts and income, is important in farm accounts and is somewhat simpler to provide in a single-entry system. Since

CASH RECEIVED

Date	Items and Description	Total Cash	Horses	Cattle	Dairy Products	Sheep and Wool	Hogs	Poultry

CASH PAID OUT

Date	Items and Description	Total Cash	Horses	Cows	Other Cattle	Hogs	Poultry	Sheep

Figure 33. Sample of Columnar Type of Cash Record. This type of record is easily kept and has the entries all classified, but it is difficult to check for accuracy and completeness and is not well adapted to studying individual enterprises currently.[1]

on most farms there is more than one person receiving and disbursing cash, it is often difficult to use the double-entry checks effectively in ensuring accuracy. Other types of checks that are easier to make with the single-entry record are better adapted to ensuring accuracy in the farm record. Most farm record books follow the single-entry system or some modification of it.

Forms of Cash Records. Cash items can be recorded with the least effort in a simple memorandum account with a column for the date, another for the item and description, and one column each for receipts and expenses. (See Figure 32.) This type of cash record in the long run requires the greatest expenditure of time, since all these items must later be classified and copied into separate accounts if they are to be used to study the business or prepare an income tax return. They provide a chronological record of financial transactions but are of limited value for reference, because like items, instead of being grouped, are scattered through the book.

In another type of book a columnar arrangement of receipts and expenses is provided. (See Figure 33.) One column is for the date, another for the item and description, and then a series

[1] Adapted from *Farm Records and Accounts*, pp. 6, 7, 32, and 33. Department of Agriculture, University of Minnesota.

CASH RECEIVED

Small Grain	Corn	Hay	Root Crops	Other Crops		Miscel-laneous	Outside	Personal	Old Bills & Notes

CASH PAID OUT

Feed	Hired Labor	Crop	Building, Fences, Tiling, Etc. (new & repairs)	Machinery, Equipment, Etc. (new & repairs)	Auto, Tractor, Engines, Gas, Oil, Repairs, Etc.	Taxes, Rent, Interest, and Insurance	General Farm	Personal	Household

of columns represent the different classifications of either receipts or expenses. It takes a little longer to make the entries in this type than in the one previously described, but they do not need reclassification for use at the end of the year. It is easier to use this form of record for reference since it is necessary to check through only one column for the information needed.

A third type of cash record provides separate pages for each enterprise or special account. (See Figure 34.) By combining the inventories with the records of cash receipt and expense on the same or adjoining pages, it is possible to segregate the information for each enterprise or class of account. It takes slightly longer to make the original entries in this type of record book, but the information is so grouped for handy reference and analysis that for the whole accounting process a large amount of time is saved and the record becomes much more useful.

Many of the farm record books distributed by the state agricultural colleges and extension services provide space not only for recording farm inventories and cash receipts and expenses but also for feed records, crop and livestock production records, reports of farm produce used in the house, and other information useful in studying the farm business. Other desirable features of some of these books are provisions for reporting credit as well as cash transactions and for making a separation of inventory and receipt and expense items between the operator and the landlord. The latter is especially valuable to a farmer operating under

10 (10)

HOG INVENTORY

10 DESCRIPTION	Year Bot.	Cost	Est. Life Years	Annual Depre-ciation	BEGINNING OF YEAR 13 No.	14 Total Wt. in Lbs.	16 Value	END OF YEAR 18 No.	19 Total Wt. in Lbs.	21 Value
Hogs raised from own herd Market Hogs							$			$
Fall Pigs										
Gilts										
Old Sows										
Boars										
Hogs originally purchased										
		$		$						
TOTAL HOG INVENTORY										

Figure 34. Sample of a Page Type of Cash Record. This sample shows the complete information for each farm enterprise or class of accounts condensed on one page or on adjoining pages. It takes a little longer to make the original entries in this type of record but it is easily checked, it is much more useful for current analysis, and in the long run takes much less time for the farmer who uses his book for farm business analysis or income tax purposes.[1]

a livestock share lease. Some of these books also contain a section for household and personal accounts. Although these different types of records are available in these books the farmer may elect to use only those in which he is interested. It is far better to use one of these well organized books, even if some portions are left

[1] *Income Tax Section of the Minnesota Farm Account Book*, p. 10. Copyright 1942 University of Minnesota.

HOGS BOUGHT **HOGS SOLD** (11) 11

23 Date	24 DESCRIPTION	25 No.	30 Value	32 Date	33 DESCRIPTION	34 No.	39 Value
			$		Hogs raised from own herd		$
					Hogs originally purchased		
TOTAL HOGS BOUGHT				TOTAL HOGS SOLD			

blank, than to improvise a book containing only those records the farmer wishes to keep.

MEASURES OF FARM EARNINGS

Some measure of farm earnings is useful in interpreting farm records. The individual farmer studying his own records is primarily concerned with the income that accrues to him as the result of his year's operations. This measure was discussed in Chapter XX. If comparisons are to be made between farmers it is important that earnings be computed on a comparable basis. It is also important that the measure of earning or financial suc-

cess reflect the results of differences in the organization and management of the farm as a unit. Some of the commonly used measures are (1) farmer's labor income, (2) operator's labor and management earnings, (3) capital return, and (4) management return. These measures do not reflect the exact money income or the net-accrual income of the farmer. They should be regarded strictly as relative rather than as absolute measures. They do not indicate the exact expendable income of the farmer and are not comparable to wages, salaries, or profits in other industries. Their purpose is solely to permit comparisons of relative success among farm units.

Computing Measures of Earnings. The farmer's gross earnings are made up of the following elements:

1. Sales of farm products, services, and the use of farm equipment.
2. Net inventory increases.
3. Farm perquisites (farm produce used by the farm family and the rental value of the farm house).

Costs or charges to be deducted from gross income in determining earnings are:

1. Purchases of goods and services for farm production.
2. Net inventory decreases.
3. Labor by the farmer and members of the family who receive no direct remuneration for their services.
4. A charge for the capital (including real estate) used in the farm business.

The items listed previously as gross income are used in all the measures named except labor income. In determining farmer's labor income and operator's labor and management earnings the costs deducted include purchases, inventory decreases, estimated wages for unpaid family labor, and a charge for the use of capital. The capital charge is usually based on a percentage of the average amount of capital. This percentage is the rate of interest that is commonly charged in the vicinity for the use of capital for such purposes. In the case of real estate an estimated rental charge may be used. The resulting net income is the return to the operator for his labor and management, above all expenses, whether they represent an actual payment or an estimated charge, including the usual market rate for capital and unpaid family labor. Labor income differs from labor earnings only in that the value of farm perquisites has been excluded from gross income and is therefore less by that amount.

Management returns differ from operator's labor and management earnings in that the costs deducted from gross income include a charge for the labor of the operator in addition to the other charges listed in the previous paragraph. They are the returns for management after all charges including capital and labor have been deducted.

In computing the return to capital a charge is made for all

TABLE LIX—COMPUTATION OF FARMER'S LABOR INCOME, OPERATOR'S LABOR EARNINGS, MANAGEMENT RETURN AND CAPITAL RETURN

	Operator's Labor and Management Earnings		Farmer's Labor Income		Management Return		Capital Return	
Farm Receipts:								
Total farm sales	$6,000		$6,000		$6,000		$6,000	
Net inventory increases	300		300		300		300	
Farm prequisites	600		omitted		600		600	
Total farm receipts		$6,900		$6,300		$6,900		$6,900
Farm Expenses:								
Total farm purchases	$3,700		$3,700		$3,700		$3,700	
Net inventory decrease*	0		0		0		0	
Unpaid family labor	500		500		500		500	
Labor of operator	residual		residual		900		900	
Capital charge	1,500		1,500		1,500		residual	
Total farm expense		$5,700		$5,700		$6,600		$5,100
Net returns		$1,200		$ 600		$ 300		$1,800†

*Since there is a net inventory increase in this case, there can be no net decrease.
† This represents a return of 6% on the investment ($1,800 ÷ $30,000 [total farm capital] = .06 x 100 = 6.)

labor, both unpaid family labor and that rendered by the operator, but no charge is made for capital. The resulting figure represents the return to capital after all expenses have been paid, including wages for all labor, either incurred or imputed. It is usually expressed as a percentage of the average amount of total farm capital. In other words, capital, rather than labor and management, is made the residual claimant.

An illustration of the method of computing each of these measures is shown in Table LIX. Some of the items, such as purchases and sales, represent monetary transactions. The inventory increase represents an accrual of value during the year. The value of the perquisites is estimated, as are also the charges for the labor performed by the operator and by members of the family. The capital charge is 5% of the average total farm capital of $30,000.

It is the usual practice in case earnings are to be used for purposes of comparison among farmers to compute them on a "full-owner" or "whole-farm" basis, as was done in Table LIX. The farm, including the capital, labor, and other factors involved in its operation, makes up a production unit. The results that accrue from this unit are more significant for purposes of comparison than the results that accrue only to the factors which the operator owns. The capital charge covers the entire amount of capital used in the business, whether owned by the operator or borrowed. Payments on the principal of indebtedness, interest payments on money borrowed, and real estate rentals are not included under expenditures. In the case of rented farms all sales, both by the landlord and by the tenant, are included in gross income, and any expenses incurred by the landlord such as taxes, insurance, upkeep, seed, and fertilizer, are included in the costs charged against income. In other words, the earnings are computed on the basis of a farm unit owned completely by one operator free from any indebtedness. This puts all farms on a comparable basis as far as tenancy and ownership are concerned. Because the amount of unpaid family labor varies widely among farms, this labor is valued on the basis of the usual rates paid to hired men for similar services and is deducted as a cost. The resulting measure of earnings or financial success represents the return to one operator owning one complete farm unit.

Of these measures, the labor income or labor earnings are most commonly used. The individual operator is more concerned with the rate of return for his services as a laborer and manager than with the rate of return he is able to secure on the farm investment. A large business, even though the rate earned on the investment may be lower than for a small business, may yield more total income to the farmer as long as the rate earned exceeds the cost of the capital. The rate earned on the investment is more significant for those types of farming in which capital costs are large relative to other charges. It is also highly significant to the landlord who is principally interested in the farm as a place to invest his capital. As a measure of farm earnings, *management return* has no particular advantage over *operator's labor and management earnings,* because one differs from the other by a constant amount. Management return is a more difficult measure to use because it is smaller and more likely to be a negative figure. It also requires an additional estimate and calculation.

COST OF PRODUCTION RECORDS

The farmer who keeps all of the records listed in this chapter has a basis for computing the cost of production of the various products raised on the farm. Such a process, however, is tedious and difficult and requires a great deal of time. It is very difficult to compute separate significant cost-of-production figures for each product because of the numerous instances of joint costs and joint production. The same labor and equipment is used to produce a wide variety of products. Mutton and wool are produced jointly, as are also eggs and meat, and milk and meat. There is little basis for computing separate costs of joint products of this kind. Many of the cost elements represent the use of the farmer's labor and property, for which no direct payment is made. Even after costs have been computed, they are likely to be misleading unless interpreted with extreme care and caution. The vast majority of farmers will use their time much more effectively with the more simple forms of farm record analysis. Cost-of-production studies have a place in a research program in farm management but hardly in the individual farmer's record program.

FARM RECORDS AS A BASIS FOR AN INCOME TAX RETURN

Adequate records of inventories, receipts, and expenses are needed as a basis for income tax returns. Internal revenue regulations require them in most lines of business and also in farming if returns are prepared on an accrual basis. Although an exception is made in the case of farm returns prepared on the cash basis, this exception is of limited value. The farmer who prepares his return on a cash basis may still be required to substantiate his claims for allowable deductions. A well-kept farm record is one of the most effective ways of supporting these claims. The farmer who makes an honest effort to report his net farm profit accurately is likely to overestimate this profit if he does not have a complete record of his business expenditures, and as a result is subject to an excessive tax. It is comparatively easy to make a fairly accurate estimate of gross income for most types of farming, since the items of income are usually sufficiently large to remember and usually are not as numerous as expense items. Marketing agencies may be able to supply the needed information on sales. There are, on the other hand, a large number of expense items highly variable as to size. Unless these are recorded currently, many will be forgotten. Each deductible expense that is forgotten

results in an addition to the total tax to be paid.

Cash and Accrual Methods Compared. Under the cash method the taxable farm income is computed from the cash receipts and cash expenses for the current year. Under the accrual method receipts and expenses adjusted for inventory differences are used. The computation of depreciation on machinery and buildings is the same under either plan. An inventory of home-raised crops and livestock is needed only for the accrual method. The principal advantage of the cash method is the fact that the tax covers the year in which money income is received. The cash method may also be used where no records have been kept. The accrual method is better suited to the usual type of farm accounting. Farm accounts are logically kept on the accrual basis because of the large inventories relative to annual sales and also because of yearly variations in the proportion of the year's production sold within the year. Where sales and inventory carry-over vary widely from year to year, the farmer reporting on the accrual basis is likely to pay a lower average tax over a period of years. The accrual method is also distinctly advantageous if the operator quits farming and sells his personal property. Under the cash method all the income derived from the sale of this property produced on the farm is taxable during the year of the sale, whereas under the accrual method the farmer is taxed only on increases in inventory values from the first of the year to the time of the sale.

Record Forms for Income Tax Purposes. The types of farm record books discussed earlier in this chapter supply the information needed for an income tax return. Oftentimes special forms and instructions are available for use with these books that make it possible for a farmer to prepare his own computation of taxable net income with a minimum of time and effort.

Many forms of records for farm income tax purposes have been made available in recent years. Few of these are of any value for purposes of studying the farm business. In fact, most of them lack space for the necessary entries and also lack sufficient itemization to be useful in checking for accuracy and completeness in the record or in substantiating claims for deductible expenses. In the long run the farmer will save time and secure a more satisfactory basis for a tax return if he uses the standard farm account books prepared by experienced farm accountants in the colleges and extension services. This record will supply a guide to management as well as tax information.

CHAPTER XXIX

THE USE OF CAPITAL AND CREDIT IN FARMING

Farming is a business that requires a substantial amount of capital. In farming, as in other business activities, one must usually build up capital needs by a period of apprenticeship, training, and saving. A person seldom steps out of school to find a good business waiting for him in any one of the various vocations that he might prefer.

If one has decided to follow farming as a life work, it is well to lay out a program for achieving that goal. It may be necessary to change plans many times; but, nevertheless, much better progress is likely to be made if a well-thought-out plan is followed. Such a program may well start by securing as good an education in agricultural subjects as circumstances permit. This preparation should include, if possible, high-school courses in agriculture and a course in an agricultural college. This type of education is a good foundation for farming, but it will have been a near-failure unless one is inspired by it with a desire to follow school studies by continued observation and study in after years. This self-culture may be accomplished through agricultural books, periodicals, and bulletins of the State Agricultural Experiment Stations and the United States Department of Agriculture. Attendance at Extension Service meetings, Farmers' Short Courses, and other group meetings that give contact with successful farmers often stimulate improved farm practices and profits. If possible, the program should also include an immediate start on a small scale in junior school or club projects.

How Much Capital Is Needed? Capital needs will be largely influenced and determined by the region in which the enterprise is undertaken and by the type of farming in which one decides to engage. As illustrative of the amount of capital used in farming, figures are taken from the 1940 United States Census for one or more counties in each of several states. (See Table LX.)

Fortunately, not all the money needed must be in hand before one starts farming. In many good agricultural counties, 40 per cent to 50 per cent of the farms are operated by tenants.

Even to operate successfully as a tenant, a capital of $2,000 to $8,000 or $10,000, depending on the region chosen and the type of farming to be followed, is desirable. Is it possible for a beginner who starts with only his hands to accumulate enough money to enable him to become a successful farmer? One of the best ways to answer this question is by inquiry among farm operators who started at the bottom and who have farmed in the

TABLE LX—DATA ON AVERAGE VALUE OF REAL ESTATE, IMPLEMENTS, AND LIVESTOCK PER FARM IN SELECTED COUNTIES—APRIL 1, 1940, U. S. CENSUS

State	County	Acres in farm	Value per Farm			
			Real estate*	Implements & Machinery†	Livestock‡	Total
Illinois	McLean	183	$23,604	$1,642	$1,205	$26,451
Indiana	Hamilton	92	9,945	917	not available	
Iowa	Story	153	16,395	1,451	1,458	19,304
Michigan	Clinton	109	6,292	1,030	921	8,243
Minnesota	Martin	178	15,516	1,722	1,731	18,969
	Stevens	267	9,279	1,721	1,298	12,298
Nebraska	York	197	9,394	862	789	11,045
N. Dakota	Cavalier	440	7,313	1,359	872	9,544
S. Dakota	Davison	290	6,999	723	1,263	8,985
Wisconsin	Barron	110	4,067	743	1,266	6,076
	Green	149	9,663	1,430	2,315	13,408

*Value per farm is based on average of all farms in the county.

†The value of machinery is based on the number of farms in the county reporting machinery.

‡The value of livestock is based upon the number of farms in the county reporting livestock.

Some additional capital is needed to provide feed, seed, and supplies.

region in which you propose to farm. If well acquainted with a given locality, one may know several farmers in the region who are reputed to be highly successful. Consultation with them and a rough estimate of their assets will often give a fair idea of the rate of progress made and of the problems to be overcome. Another way to test the possibilities for gain is to note the size of the larger estates left by farmers in the locality in recent years. In good agricultural regions, some farmers will be found who have built farms worth $20,000 to $50,000 or who have left estates of that size. Some of these may have secured a portion of their accumulations by inheritance or marriage, but usually some individuals are found who have achieved such success by hard work and frugal living combined with capable management. If this type of individual is fortunate in having an able, sympathetic, and co-operative wife, the chances of success are greatly increased. If, in a given locality, the best farmers are found to be worth only

$4,000 to $8,000 at the end of a long period of years, one may safely assume that such a sum represents the upper limits of the possibilities in the region. It is well to profit by their experience. In such a region one should hesitate to take on heavy financial obligations.

OTHER REQUIREMENTS. In addition to capital, a successful operator needs the practical experience that is acquired by growing up on a farm, participating in all phases of the farm work and planning or by working as a hired hand on a well-managed farm. Even if one has been reared on a farm, it may be advantageous to get the experience and viewpoint of capable farmers who are not relatives. It is advantageous to get part of that experience, if possible, by working at some distance from home, where the problems are different than in the home locality and will be more broadening.

One of the great advantages of the farming business is that parents can aid their children in gaining experience both in agricultural techniques and in business matters by giving them an opportunity to enter a junior partnership project, such as described in Chapter VIII, and participate in its financial management. In connection with these projects, modest amounts of money may sometimes be borrowed from interested individuals or commercial institutions. Such activities, if prudently conducted, may aid one to a better understanding of business practices. If one punctually cares for all such obligations, a reputation for trustworthiness will be established among those with whom he has business dealings. Such activities may enable one to build up a business asset in the form of "a good credit rating" which may serve well at any time that additional capital is needed for an emergency or for further expansion of the enterprise.

SUPPLYING THE NEED. The need for capital will be supplied so far as possible from accumulated funds. These may have been derived from inheritance or gift, or as earnings from a junior partnership home project, or savings as a wage-earning farm hand or from some other similar source, or from a combination of these sources. The larger the accumulation of capital owned, the less need will there be for paying interest charges on capital that must be borrowed. When investing accumulated capital in farm property, one should make reasonably sure, however, that the investment will earn at least as much as it would if placed in a savings bank or used for the purchase of a government bond or other safe security.

If more capital is needed than the individual owns, it will be necessary to seek the additional capital from some individual or agency willing to supply it on a credit basis. The term credit, as commonly used, may be defined as the privilege of getting the immediate use of facilities or services, and paying for them at some later time, as agreed by lender and borrower. For the privilege of immediate use of the needed facilities or services, the borrower should earn enough by the use of them to pay interest on the loan. In many cases, when wisely managed or used, they may pay more than the interest rate. This result, in fact, is the hope of the borrower, and, perhaps, the impelling reason for seeking the loan.

In order to get credit advantageously, it is ordinarily necessary that the borrower be the owner of some money or property. This qualification is desired by the prospective lender for two reasons:

1. If the borrower has accumulated the money by his own efforts and self-denial, it is clear that he has solved the ever-present problem of living on a sum smaller than his income and is likely to continue to do so.

2. The accumulated capital, as a stake in the enterprise, serves as a guarantee that the obligation will be paid even though the venture should prove unprofitable. Before borrowing money, one should satisfy one's self that the contemplated investment will pay for itself and leave a good margin of profit. If the venture looks like a profitable one, it will also appeal to the lender, as the outlook for profits, together with a good reputation as an honest borrower, is a fair assurance that the loan will be repaid when due.

When Is It Wise to Borrow? The purpose of borrowing is to gain immediate use of money or capital goods that can be made to earn more than the cost of borrowing. A careful analysis of each venture for which borrowed money is to be used should be made to determine the probable returns from it. Unless definite gains are in prospect, it may be unwise to seek the loan. A method of analyzing a credit problem may be illustrated by considering a prospective purchase of five dairy cows at $125.00 each. Suppose that the cows have been located and are suitable. It will be well, before purchasing, to make some careful estimates of the probable results. A good starting point will be to consider the portion of the income from milk or butterfat that is likely to go for such overhead items as depreciation, interest.

and death losses. These may be figured on a per-cow basis:

First cost	$125
Interest rate	6%
Useful life	5 years
Death loss (average of a large number)	2% per year
Final slaughter value	$ 40
Production of butterfat, 300 lbs. per year @ 45c	135

The following are the depreciation charges per year:

First cost	$125.00
Less final slaughter value	40.00
Depreciation in 5 years ($125 less $40)	85.00
Depreciation per year (1/5 of $85)	17.00

An approximate summary of the yearly overhead:

Depreciation	$17.00
Death risk, 2% on average value of $82.50	1.65
Interest on average value of $82.50 at 6% [1]	4.95
Total overhead cost per cow	$23.60

At 45c per pound of fat, it will require approximately 52 pounds of fat, or one sixth of the product, to meet the expected annual overhead of $23.60 for depreciation, death risk, and interest. If enlarging the herd by five cows requires additions or repairs to the barn, a bigger cream separator, or other equipment, then the annual depreciation, interest, and repairs on these items should be added to the overhead items already considered. As the expected production is 300 pounds per cow, the question is whether 300 pounds less 52, or 248 pounds of butterfat, will pay the feed cost, salt, water, bull service, and other expenses and still leave a worth-while return for the labor.

From Table XXI, Chapter XIV, we find that a cow giving 300 pounds of butterfat annually will require:

An average of 2,450 lbs. of concentrates	Figured @ 1½¢	$ 36.75
An average of 6,500 lbs. of roughage	" @ ½¢	32.50
2 acres of pasture	@ 3.00	6.00
Total feed cost		$ 75.25
Bull service and incidentals		5.00
Total cost per cow		$ 80.25
Value of 248 lbs. butterfat @ 45c		$111.60
Cost per cow per year		80.25
Return for labor		$ 31.35

[1] Interest is figured on the average investment in the cow (½ [$125 + 40]) = $82.50), because, when depreciation is figured, theoretically, a certain sum is received from the investment in the cow and set aside toward replacing the cow when her usefulness is at an end.

Good dairymen figure that 130 to 150 hours of labor are required annually to care for a dairy cow. Allowing 130 hours in this instance, the $31.35 return to labor figures out at 24c an hour. This is a small return to labor. One should remember, however, that otherwise unsalable feeds may be marketed through livestock and that often the cows are cared for by family labor that must be supported whether employed or not. The 24c an hour may be practically clear gain if the labor would not otherwise be used. The loan may safely be made, as the overhead charges and feed are covered by the returns, with a modest wage to labor in addition. The return to labor may be increased by reducing feed costs or by increasing the yield of butterfat per cow by a more suitable feed ration.

In the case of beef cows, the estimates for overhead, depreciation, interest, and death loss can be measured against the value of each calf raised. In the case of ewes, one can estimate the return per ewe in the form of wool and lamb and deduct the overhead for depreciation, death losses, and interest. Then the question will be whether the calf or the lamb will show a profit after deducting feed and labor costs.

The wisdom of purchasing a machine may also be tested. Suppose that one must borrow for the purchase of a combine costing $1,000. Assuming a 10-year life, a 6% interest rate, $15.00 a year for repairs and $10.00 for taxes and insurance, the annual cost would be as follows:

Average annual depreciation	$100.00
Interest on average value of $500 (½ of $1,000=$500) at 6%	30.00
Repairs and upkeep	15.00
Taxes and insurance	10.00
Total	$155.00

The annual overhead of $155.00 plus the probable annual outlay for fuel oil and operating expense, may be compared with the cost of hiring the combining done. It may be better business policy to hire the work done for a year or two than to buy a combine for which there is not sufficient use to make it a profitable investment.

Many operators obtain loans without allowing for these overhead charges. As a result, they borrow more than the enterprise can carry and find that the loan, instead of being a help, has become a heavy debt burden.

SOURCES OF CREDIT

After figuring carefully the probabilities of gain or loss from the venture and measuring the need for additional capital, attention should be given to the sources of credit most readily available, and from which source it can be obtained on the most reasonable terms from the long-time point of view. Among these sources will be: (1) the seller of the goods, (2) relatives or other individuals having surplus funds, (3) Federal Co-operative Credit Agencies, (4) Government-owned agencies, (5) commercial banks. Which source to use depends upon the amount of the loan, the rate of interest asked, and the length of time desired before repayment. Some agencies make a specialty of short-term loans, while others are organized to make long-time mortgage loans on real estate or business properties. The merits of these sources will be discussed.

THE SELLER AS A SOURCE OF CREDIT. Very often the seller of livestock, machinery, equipment, or even of real estate is willing to take a moderate down payment on the sale and accept the buyer's note for the balance at an agreed rate of interest. The rate among such lenders varies greatly. In many cases, the note will be carried at about the rate that would be charged by a commercial bank on short-time "over the counter" loans. In others, the interest charge will be stretched to all that the buyer can be induced to pay. Unless the buyer has established a reputation for being "a good credit risk," the seller is quite likely to ask for a mortgage on the property sold or for other satisfactory security such as life insurance policies or government bonds.

It is not uncommon for storekeepers to carry farmer customers on grocery and supply items through the summer until crops are harvested. The borrower may feel that this concession is an interest-free loan. It stands to reason, however, that the interest charge is often concealed in higher prices for the goods purchased. One should open such accounts only with the full knowledge that the seller is not going without interest on goods advanced. Often the cost of the goods will be higher than if money is borrowed at a bank and cash is paid for them. Installment buying, which is often practiced by farmers as well as by others, also carries a hidden interest charge which should not be overlooked by the purchaser.

Farmers are more likely to purchase machinery on time than any other goods. Implement dealers are quite willing to offer

credit to reliable farmers who make a fair down payment on the goods and give a secured note for the balance. Even though only the current rate of commercial loans is charged, the buyer may be paying more for the goods than is necessary. The following instance will illustrate this point.

A dealer offers a farmer a tractor for $1,000. He asks a down payment of $300.00, and will take the farmer's note for the $700.00 balance due in one year at 6% interest. The total cost of the tractor under this offer will be $1,042. The dealer offers to discount the price of the tractor $50.00 for full cash payment. The farmer has only $300.00 in cash. He can, however, obtain a bank loan for the $650.00 needed ($700 unpaid balance less $50 cash on discount) at 6% on a one-year note. By taking this latter course, he would pay $950.00 plus $39.00 interest on $650.00 or $989.00, for the tractor. There would thus be a saving of $53.00 over the first proposal, or 5.3% on the original price of the tractor. Or, to put it another way, the acceptance of the first proposal would have cost the farmer the equivalent of an interest charge of over 13% on the $650.00 loan.[1] Obviously, one should carefully analyze the alternatives before letting the seller "carry the loan."

Credit from Relatives or Other Individuals. Young men who are starting on a well-founded plan for operating a farm often get assistance from relatives or others interested in their success. A well-to-do father may be in position to give substantial financial support to a son or other relative. Sometimes such support may be given at little or no interest charge and without particular regard to the security for the loan. To that kind of support there can be but little objection unless it results in an injustice to other members of the family or may seriously impair the financial standing of the father. In the case of an only child, no question of partiality can be raised. Where there are several children in a family, it may lead to family quarrels unless similar favors can be granted to each. The same arguments apply to uncles, aunts, or other relatives who may take an interest in an individual and wish to help such a one to become established in farming. About the only advantages of loans from such sources are low interest rates, easier terms, and a tendency to "forgive" the loan, should the borrower experience a period of *"hard luck"*

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[1] Discount $50 + Interest $39 = $89—the total cost of credit, $89 divided by $650 = 13%, the actual annual cost of the credit.

which is usually an alibi for poor management. Such concessions might result in less thrifty management and in family friction that might follow failure to make good. Should it be deemed advisable to accept loans from a relative, a full written agreement should be prepared in each instance, stating the amount of the loan and the terms upon which it is made. Supporting notes, mortgages, or other legal documents should be executed and filed just as would be done in making a contract with a commercial credit agency. Each party to the agreement should sign as required and have a copy for ready reference when desired. These steps, if followed, will avoid much difficulty, should an emergency necessitate probate court proceedings or other legal action.

While loans from relatives do sometimes work out satisfactorily, it will be better, in the long run, to obtain loans from institutions that are permanently in the loaning business and in a position to look after the loan in a business-like manner. Loans obtained from outside sources will not endanger the family relationships and in the long run are more advisable.

Bank Credit. Commercial banks organized under state and national charters are everywhere recognized as standard sources of credit for a great variety of borrowers. They were for many years, and, in fact, still are, regarded as a chief source of credit. Located in nearly every country town of moderate size, they may be conveniently reached and are usually in position to accommodate the prospective borrower on short notice. They are also in position to inspect the property on which a loan is desired and to complete their transactions without publicity. These features appeal to many borrowers and make such institutions attractive, particularly to those wanting short-term loans.

For many years banks and other commercial loaning agencies enjoyed a comparative monopoly in supplying short-term credit needs. They also supplied a substantial portion of the mortgage loans on real estate. During that period, high interest rates prevailed on both types of loans, and the real estate mortgages were usually for three to five-year terms. These two facts called for frequent renewals involving special fees for executing, filing, and recording papers. Under competition from co-operative credit institutions set up in recent years through congressional enactment and fostered by the Federal Government, rates and terms have been reduced and loans can be obtained from either source at more moderate cost than formerly.

INSURANCE COMPANY LOANS. Insurance companies have been an important source of real estate credit in the better farming areas. Farm mortgages have been looked upon in the past as good investments and carried high interest rates, but insurance companies buying farm mortgages as investments have unexpectedly and unavoidably acquired many farms through inability of borrowers to pay the interest charges and meet payments on the mortgages. These have been carried by the companies and operated by tenants until they could be resold. Sales of such farms are now being made on long terms of repayment and at favorable interest rates.

FEDERAL CO-OPERATIVE AGRICULTURAL CREDIT AGENCIES

Within the past quarter century, special agricultural credit institutions have been developed under Federal supervision. They now hold a large place in meeting the credit needs of farmers. These institutions began in 1917 with the organization of the Federal Land Bank system, under Congressional Act of July, 1916. Further organization was authorized in 1923, when the Federal Intermediate Credit Bank was set up to assist in supplying credit to farmers by either discounting or purchasing short-terms loans made by local Agricultural Credit Associations.[1] In 1933, through congressional enactment, the Farm Credit Administration was created with the expectation that it would meet all credit needs of farmers through the medium of co-operatively owned and operated credit institutions.

Under "The Farm Credit Act of 1933," the Federal Land Banks and the Federal Intermediate Credit Banks, which had been operating under the jurisdiction of an appointive Federal Farm Loan Board, were placed under the direction and supervision of a newly created and independent division of government, responsible to the President of the United States and to the Congress. At this time, two new units were added to the Agricultural Credit Group. These were the Production Credit Corporation and the Bank for Co-operatives. The new group was named the Farm Credit Administration. It consisted of the four

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[1] In reality the F. I. C. B. does not always discount the notes. The present practice is to buy the notes at face value when acceptable under the regulations of the system. The F. I. C. B. then bills monthly the associations from which it has purchased notes, at the prescribed interest rate, which is currently 1½%. The associations making the original loans are allowed to charge borrowers 4½%. On the 3% differential the associations pay office rent, salaries, and other operating expenses, and meet such losses as may be incurred.

credit agencies: (1) The Federal Land Banks, (2) The Intermediate Credit Banks, (3) The Production Credit Corporation, (4) The Bank for Co-operatives and was placed under a directing head known as the Governor of the Farm Credit Administration. The central administrative office of the Farm Credit Administration was established in Washington, D. C. In January, 1934, Congress authorized an additional credit agency known as the Federal Farm Mortgage Corporation to supplement the Land Banks in meeting the credit needs of farmers who were in danger of losing their farms through foreclosure during the depression emergency then prevailing.

The Federal Farm Mortgage Corporation was authorized to make second-mortgage loans in cases where there was a strong probability of repayment, but where the Federal Land Bank felt that the mortgage was not acceptable as security for Land Bank Bonds that were being offered to the public.

Under congressional authorization, the President of the United States, in April, 1939, transferred supervision of the Farm Credit Administration and the Federal Farm Mortgage Corporation, together with the Commodity Credit Corporation, to the United States Department of Agriculture. The Farm Credit Administration, which includes the central administrative offices, has office headquarters in Washington. Regional offices in each of the twelve Land Bank districts were authorized under the original Act of 1916. These districts are shown in Figure 35.

At each of the district headquarters, there is: (1) A Federal Land Bank, (2) A Federal Intermediate Credit Bank, (3) A Production Credit Corporation, and (4) A Bank for Co-operatives. A Vice-President of the Federal Farm Mortgage Corporation represents the Corporation at each of these district offices and works in close co-operation with the officers of the Land Bank.

Functions of the Federal Land Banks. Federal Land Banks obtain money for making loans to farmers by selling Land Bank Bonds to commercial banks, investment brokers, individuals, or any others having money to invest. The loans are made through local organizations of co-operative credit groups of farmers known as National Farm Loan Associations. A secretary-treasurer is employed as manager of the Association office and general executive. A loan committee made up of member farmers is named, who pass upon the merits of the request and make recommendation. Loan inspectors are employed as needed.

A farmer who wishes to obtain a Federal Land Bank Loan makes an application to the Secretary-Treasurer of a local National Farm Loan Association serving the area in which the farm on which he wishes the loan is located. The Secretary, working with a loan committee composed of members of the Association, investigates the request and examines the farm. If satisfied that the loan is a reasonable one and that it probably can be repaid from the income of the farm in normal times, the

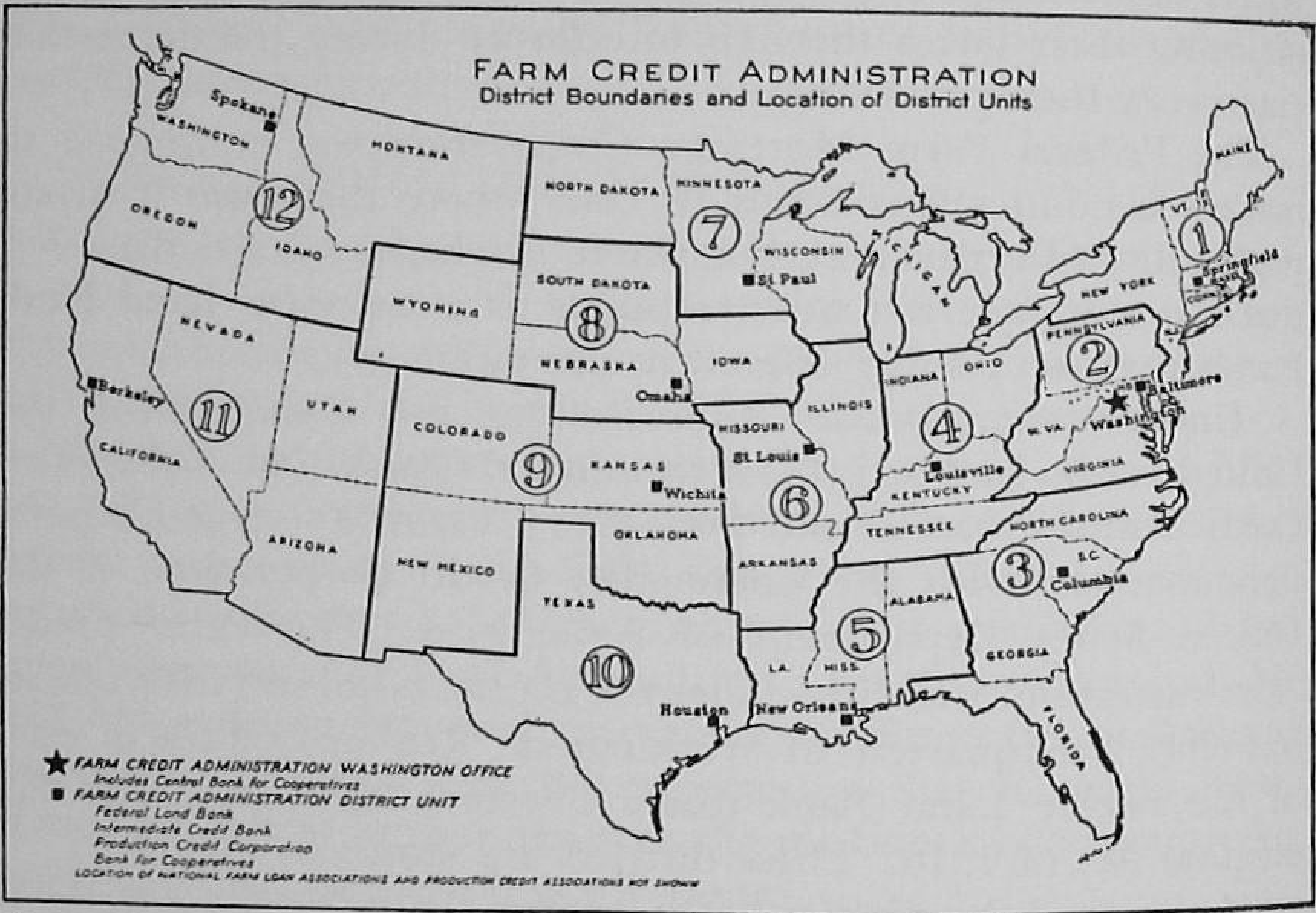

Figure 35. A map showing the district areas of the Farm Credit Administration

application is sent to the Federal Land Bank of the district, with a favorable recommendation signed by the committee. The Land Bank then makes an investigation of the farmer and has the farm appraised. If the loan appears to be for not more than 65% of the normal value of the property and the borrower has a good reputation as a farmer and business man, the loan is approved and granted. A mortgage on the farm is made and the note endorsed by the National Farm Loan Association to the Federal Land Bank, thus to a certain extent co-operatively protecting the Land Bank against loss.[1] Land Bank loans are made on 20 to 34-year terms on

[1] The endorsement is made by the loan committee officially representing the N. F. L. A. involved and has the effect, when signed by the individual committee members, of putting the resources of the association back of the individual loan. It thus becomes a co-operative responsibility. These resources consist chiefly of the capital stock subscribed by the members.

a plan of amortization which usually requires twice-a-year payments on principal with interest accruals.

Each farmer obtaining a Land Bank loan must become a member of the Land Bank system by becoming a member of his local National Farm Loan Association. He is required to purchase stock equal to 5 per cent of the face of the loan, and pay an appraisal fee, the incidental expense of providing an abstract of title, and such filing and recording fees as may be necessary. In case the needs of the borrowers are not fully met by the Land Bank loan under the law as of April, 1942, a second mortgage loan may be made by the Federal Land Bank as agent of the Federal Farm Mortgage Corporation. The total of the two loans can not exceed 75% of the value of the mortgaged property. The authority to make such loans has been extended to July 1, 1947, by act of Congress.

The Individual Mortgage Loan Record form in Table LXI shows the payments due on a $1,000 mortgage loan at 4% and the distribution of the semi-annual payments as between interest accruals and principal payments due.

The advantages of a Federal Land Bank mortgage loan lie in the long-term amortization plan and a relatively low rate of interest. This plan relieves the borrower of the necessity of frequent mortgage renewals with the attendant expense and from the worry concerning possible inability to get it renewed. Interest rates of Federal Land Bank loans depend upon the interest charges the bank must pay to the investors for money which it uses for loaning purposes. The contract interest rate on Federal Land Bank mortgages is currently 4%.

One contemplating a farm mortgage loan should visit the Secretary-Treasurer as the local representative of the National Farm Loan Association for his area, to get information about the possibilities for obtaining a satisfactory Land Bank loan.

FUNCTIONS OF PRODUCTION CREDIT CORPORATIONS. Production Credit Corporations do not loan money to farmers directly. Their function is to supervise the operation of local Production Credit Associations which handle co-operatively short-term credit for farmers, largely for current operating expenses. Production Credit Associations are composed of member borrowers who run their association somewhat as a bank, but on a nonprofit basis. Each member borrower must purchase stock to the amount of 5% of the loan when the loan is made. Production Credit Associations usually operate over an area of one to several counties.

depending on the density of population and prospective credit needs. Loans are usually made for three months to a year; but, in exceptional cases, loans are made to farmers operating in the area for periods of a few months up to 18 months. Chattel mortgages are required on loans made as determined in the judgment of the Secretary-Treasurer and the loan committee. The notes taken by the association are discounted [1] or purchased by the Federal Intermediate Bank when found to be acceptable, thus providing the association with funds with which to make additional loans. The interest rate charged by associations to farmers depends upon the interest rates the associations have to pay to the Federal Intermediate Credit Banks for loan funds. That, in turn, depends upon what the Federal Intermediate Credit Banks have to pay on the money they get from the investing public by selling short-term securities and upon the spread required to properly conduct the PCA business. The interest rate charged currently is 6%.

THE FEDERAL INTERMEDIATE CREDIT BANK. The Federal Intermediate Credit Banks function merely as discounting institutions for Production Credit Associations and privately organized Agricultural Credit Corporations and banks. They do not lend money to farmers or others directly. These banks serve agriculture by making it possible for farmers operating in groups to reach the large money markets of the world, thus gaining the advantage of lower interest rates. Farmers deal with the Federal Intermediate Credit Bank only through the Production Credit Associations, Agricultural Credit Corporations, or other agricultural loaning institutions.

THE BANK FOR CO-OPERATIVES. A Bank for Co-operatives is included in each Farm Credit Administration district. There is also established a Central Bank for Co-operatives at Washington, D. C. These banks make loans only to agricultural co-operative organizations engaged in providing for co-operative farm services, such as Farmers Elevators, Co-operative Creameries, Co-operative Oil Companies, and Co-operative Canning Companies. They may supply funds to any co-operative engaged in purchasing or marketing farm supplies and goods of an agricultural nature. Funds are supplied through these co-operative loans at low interest rates, varying from 2¼% to 4%, depending on the nature of the loan and the purpose for which made. No

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[1] For explanation of the term *discount* see footnote page 394.

Form 1201C
Transfers

4% TABLE LXI

INDIVIDUAL MORTGAGE LOAN RECORD
THE FEDERAL LAND BANK OF ST. PAUL DISTRICT No. 7

LOAN NO.____________

Name | *P. O.* | *State* | *Appr.* | *Land Val. $* | *Dated* | *Matur.* | *Bldgs. $*

PRINCIPAL, $1,000. RATE, 4% SEMI-ANNUAL INSTALLMENTS, $27.00 FINAL INSTALLMENT, $4.60

PENALTIES		AMORTIZATION TABLE						
Date Pd.	Amt.	YEAR DUE	NO.	INTEREST	PRINCIPAL	DATE PAID	INI-TIAL	BALANCE
		19	1	20.00	7.00			993.00
		19	2	19.86	7.14			985.86
		19	3	19.72	7.28			978.58
		19	4	19.57	7.43			971.15
		19	5	19.42	7.58			963.57
		19	6	19.27	7.73			955.84
		19	7	19.12	7.88			947.96
		19	8	18.96	8.04			939.92
		19	9	18.80	8.20			931.72
		19	10	18.63	8.37			923.35
		19	11	18.47	8.53			914.82
		19	12	18.30	8.70			906.12
		19	13	18.12	8.88			897.24
		19	14	17.94	9.06			888.18
		19	15	17.77	9.23			878.95
		19	16	17.58	9.42			869.53
		19	17	17.39	9.61			859.92
		19	18	17.19	9.81			850.11
		19	19	17.01	9.99			840.12
		19	20	16.80	10.20			829.92
		19	21	16.60	10.40			819.52
		19	22	16.39	10.61			808.91
		19	23	16.18	10.82			798.09
		19	24	15.96	11.04			787.05
		19	25	15.74	11.26			775.79
		19	26	15.51	11.49			764.30
		19	27	15.29	11.71			752.59
		19	28	15.05	11.95			740.64
		19	29	14.81	12.19			728.45
		19	30	14.57	12.43			716.02
		19	31	14.32	12.68			703.34
		19	32	14.07	12.93			690.41
		19	33	13.81	13.19			677.22
		19	34	13.54	13.46			663.76
		19	35	13.28	13.72			650.04
		19	36	13.00	14.00			636.04
		19	37	12.72	14.28			621.76
		19	38	12.44	14.56			607.20
		19	39	12.14	14.86			592.34

AMORTIZATION TABLE							PENALTIES	
YEAR DUE	NO.	INTEREST	PRINCIPAL	DATE PAID	INI-TIAL	BALANCE	Date Pd.	Amt.
19	40	11.85	15.15			577.19		
19	41	11.54	15.46			561.73		
19	42	11.23	15.77			545.96		
19	43	10.92	16.08			529.88		
19	44	10.60	16.40			513.48		
19	45	10.27	16.73			496.75		
19	46	9.94	17.06			479.69		
19	47	9.59	17.41			462.28		
19	48	9.25	17.75			444.53		
19	49	8.89	18.11			426.42		
19	50	8.52	18.48			407.94		
19	51	8.16	18.84			389.10		
19	52	7.79	19.21			369.89		
19	53	7.39	19.61			350.28		
19	54	7.01	19.99			330.29		
19	55	6.60	20.40			309.89		
19	56	6.20	20.80			289.09		
19	57	5.78	21.22			267.87		
19	58	5.36	21.64			246.23		
19	59	4.93	22.07			224.16		
19	60	4.48	22.52			201.64		
19	61	4.03	22.97			178.67		
19	62	3.58	23.42			155.25		
19	63	3.10	23.90			131.35		
19	64	2.63	24.37			106.98		
19	65	2.14	24.86			82.12		
19	66	1.64	25.36			56.76		
19	67	1.13	25.87			30.89		
19	68	.62	26.38			4.51		
19	69	.09	4.51					

(INTEREST PAYMENTS RULED OUT ARE NOT PAID)

Pursuant to the provisions of The Federal Farm Loan Act, the undersigned National Farm Loan Association hereby indorses and thereby becomes liable for the payment of the indebtedness evidenced by the within note, in accordance with the terms of said note and mortgage and the provisions of said Act.

In Witness Whereof, the said National Farm Loan Association has caused this endorsement to be executed for it and in its name by its Secretary-Treasurer.

The________________________________National

Farm Loan Association of________________________________

By________________________________

Its Secretary-Treasurer

loans are made direct to farmers by the Banks for Co-operatives or to other than agricultural co-operatives.

Loans from Government-Owned Lending Agencies. During the depression and drouth period prevailing 1929-39, several agencies other than those just described were authorized by Congress and supplied with Federal funds to give assistance to farmers who were seriously distressed by crop failures, low prices, and other circumstances over which they had little or no control. Among these were:

1. The Farmers Home Administration, authorized to make closely supervised loans to finance the necessary farm and home needs of farmers and stockmen who are unable to obtain credit from other sources such as Production Credit Association, National Farm Loan Associations, or commercial banks at rates and terms for loans of similar size and character prevailing in or near the community where the applicant resides.

These loans may be made for the following purposes:

a. To purchase necessary livestock, farm equipment and farm equipment repairs, seed, feed, fertilizer, lime, farm supplies and other farm needs including memberships in farm purchasing and marketing and farm service type co-operative associations.

b. To pay for necessary hired labor during peak seasons or emergency periods or for necessary custom work or services.

c. To pay debts secured by liens on chattels essential to the applicant's farming operations and under certain circumstances, cash rent in advance.

d. To erect necessary minor buildings or make necessary minor repairs or improvements to real estate (limited to $1,000 within a 12 months' period).

e. To pay taxes and insurance premiums on property or insurance policies serving as security for F.H.A. loans.

f. To purchase essential home equipment and home equipment repairs.

g. To meet family subsistence needs, including expenses for medical care.

These loans carry a 5% interest rate and are limited to a total amount of $5,000 for an initial loan, $5,000 within any one fiscal year and a total debt load of $10,000.

2. The Tenant Purchase Act, providing loan funds with which to assist capable tenants and former service men who are unable to obtain credit elsewhere under acceptable terms to be-

come farm owners. These loans are made on a variable payment plan with interest at 4 per cent. Under Federal and local investigation and supervision, farm properties are purchased, equipped and operated. As progress is made toward ownership and skill as a farmer, the farmer more and more assumes entire responsibility for the operation of the farm and is expected eventually to pay off the loan and own the farm clear from debt.

3. Rural Electrification Administration, specifically to aid in the provision of electric current and to enable farmers to purchase equipment for electric lights and power on farms.[1]

WHAT SOURCE OF CREDIT SHALL I USE?

The obvious answer to that question is to get the loan wherever it can be obtained on the most suitable long-time servicing terms and the lowest long-time cost in fees and interest. It, therefore, becomes a matter for investigation and careful calculation. The nature of the enterprise for which funds are wanted, the prospects for profitable use, and plans for repayment all enter into the problem. Sometimes it may be wise to accept a loan from a fair-minded seller of the goods or commodity wanted, if terms and rate are as good as can be obtained elsewhere. Usually, however, one finds that interest payments to such sources run rather high. The easy policy of borrowing or buying on time from a number of sellers is likely to lead to an accumulation of debts on which more direct or indirect interest will be paid than would be paid where funds are borrowed in one place and cash paid for the purchases. One should shop around and bargain for credit just as one bargains for a new machine, a suit of clothes, or any other commodity or goods wanted. The loan obtained, however, should fit the need and purpose for which made.

GOOD REPUTATION VALUABLE TO BORROWER

It is an asset of importance to a farmer to establish a reputation for being a "good credit risk." He can do so by following careful business methods. Some of the things he must do to establish such a reputation are:

1. Borrow only when absolutely necessary. The reputation of buying wisely and paying cash for all goods purchased not

[1] These three sources are looked upon as emergency sources and in so far as new business is concerned are subject to reorganization or withdrawal by Congress at any time.

only saves money in the end but quickly adds to the credit standing of the farm operator. Loaning agencies are reluctant to loan to those who are accustomed to running store bills and buying on time or installment plans. The one who pays cash is entitled to a better price than one who asks the dealer for time in which to pay. He may not get a concession for cash, unless he asks for it. If he does not get it, he is helping the seller to "carry" those who do not pay cash.

2. Promptly meet all obligations when due. If, for any reason, the loan can not be repaid when due, see the lender and, if possible, arrange a renewal. Promptness in meeting notes and other obligations when due adds greatly to one's standing as a credit risk. Credit agencies keep an accurate record of the progress made by borrowers and of the way in which they meet their obligations. Failure to pay a note when due or to renew the note, if it can not be paid, is a serious default, which may react against the borrower when another loan is needed. If, through some adverse circumstance beyond the control of the borrower, it becomes impossible to pay the note when due, the problem should be discussed promptly with the lending agency with a view to having adjustments made and a renewal arranged.

3. Borrow for productive purposes only. Usually, farmers borrow money to make more money. To accomplish this purpose, borrowed money should be used for productive purposes. Money borrowed to purchase seed or fertilizer is likely to be returned in the resulting crops. Money borrowed for a vacation trip or a radio or for painting a building is not likely to add anything to the ability of the borrower to pay the loan. The purchase of an additional cow or brood sow would add more to the productive power of the farmer and more nearly insure the repayment of the loan.

4. Work out a reasonable repayment plan. Plans for repayment should be made before a loan is requested. Loans for crop production may well be timed to payment when the crop will be harvested and sold. Loans made for the purchase and fattening of beef cattle, lambs, or other meat-producing animals should be repaid when the animals are sold. Loans for longer time production turnover should be for longer terms, with provision for partial payment from time to time. If dairy cows are kept, a certain percentage of the monthly cream check is frequently applied to the payment of the loan.

5. File with the lender a financial and net-worth statement

which should be renewed annually to show progress made. Well-established lending agencies now require credit statements from customers before making loans. Farmers sometimes object to giving such statements on the ground that it is giving publicity to what they regard as their private business. But the one who asks another to share a risk with him should willingly give full information as to how great a risk is involved. An annual inventory, together with an operating summary statement of receipts and expenses, will give the information wanted. Such summaries are useful not only in securing the loan but also aid the operator to measure the progress being made. There should be no hesitancy on the part of the borrower in furnishing the lender such a statement as a factor in getting the desired loan.

HOW MUCH SHOULD I BORROW?

Since interest must be paid on borrowed money and interest adds to the costs of operation, it is obvious that the less borrowed, the less the expense. Many farmers are tempted to borrow too much. Frequently, one will say, "I need all I can get." There is grave danger that one who must have "all he can get" will not be engaged in farming permanently. Any adverse circumstance, such as illness in the family, poor crops, unexpected low prices, animal diseases, or a combination of these may put him at the mercy of his creditors. It may become necessary for him to sell all his property to satisfy the obligations. If the property does not bring enough to cover the debts, an embarrassing judgment against future earnings of the creditor may be awarded to the lender. A safe rule is to borrow the least that can be made to serve the purpose in view. The largest possible short-term loans should be used only in a dire emergency.

GIVING CHATTEL MORTGAGES ON SHORT-TERM LOANS

Until a good reputation as a credit risk has been established and a satisfactory credit statement can be shown by the borrower, security of some kind is usually required on short-term loans. The security may be composed of high-class stocks or bonds, life insurance policies, or other salable collateral. In the absence of such collateral, a chattel mortgage may be required on the goods or property covered by the loan. Many farmers hesitate to give mortgages on personal property for fear of losing

it if the loan is defaulted for any reason. Since, through a judgment gained by court action, any property not exempt by law can be taken to satisfy the claim, there is little reason for withholding a chattel mortgage except on that property which is exempt from execution. Under the laws of most states, 40 to 160 acres of land and a modest amount of the most necessary personal property is exempt, and, if free from mortgage, can not be taken to satisfy a debt. Few farmers, however, wish to take advantage of the exemption laws to enable them to dodge the payment of legitimate debts.

There are valid reasons for avoiding chattel mortgages, however, which well may be noted. In the case of sale of livestock, grain, or other products covered by a chattel mortgage a good title can not be given without a release from the holder of the mortgage. This is sometimes hard to get, particularly if the proceeds are wanted for any purpose except to apply on the note which is secured by the mortgage. Even though the remaining security is more than ample for the size of the loan, the holder of the mortgage may refuse to give a release unless the proceeds are applied on the note. Sale of the property without turning over the funds to a mortgage holder is punishable by prison sentence, unless arrangements are made with the mortgage holder for a release of the security.

Another reason for avoiding a chattel mortgage, if possible, is that mortgaged property can not be moved freely from county to county or from one state to another without renegotiating the deal. There is no disgrace in giving a chattel mortgage, but it does sometimes result in inconvenience.

PURCHASING REAL ESTATE ON CREDIT

Nearly all purchases of farms involve the use of credit over a period of years, with the purchased real estate used as security for the loan. If, as a tenant, one has succeeded in accumulating good livestock and machinery equipment free of debt and in addition has a substantial sum of money with which to make a down payment, one is in a position to consider the purchase of a farm. One's whole future financial success is at stake in the purchase of a farm. The deal, therefore, should be carefully considered from every angle. If a man is buying a farm which he has worked as a tenant or one that he has had under his observation for several years, he is much more likely to make a satisfactory deal than if he has seen it only one or twice before buying.

Usually, one finds that a farm purchased after only one or two inspections is not as desirable as it was thought to be.

In buying a farm, the purchaser sometimes takes one that needs repairs to the buildings, eradication of weeds, drainage, land clearing, or other improvements, because it can be secured at a lower price than one in good condition. If the inferior farm is purchased, the cost of the improvements should be carefully calculated with the aid of someone who is well experienced in such matters. Due allowance should be made for the fact that the better farm will be fully productive from the start.

Frequently, one finds, after such calculations are made, that the higher-priced one of two farms under consideration may be the cheaper. If one buys the higher-priced farm, the improvements are already financed as a part of the purchase money contract or mortgage. If one plans to make the improvements from time to time and has put all his available cash into a down payment on the farm, probably the only way in which he will be able to finance the improvements will be either to put a mortgage on his cattle or equipment or to buy needed material from dealers on open account or by installment contracts. Either method is likely to be embarrassing and costly, as most improvements do not pay for themselves rapidly enough to warrant getting them on short-term credit.

A method of summarizing the comparative desirability of farms is illustrated by a case in which a prospective purchaser was comparing two farms thought to be fairly similar as regards both buildings and soil except that farm No. 2 was in a run-down condition. The barn needed a new roof, paint, and repairs to the foundation. The machine shed, chicken house, and granary needed $150.00 for repairs to roofs, doors, and foundations. The farm fences were in poor condition, and it would require an expenditure of $500.00 to make them the equal of those on farm No. 1. There was a low spot that needed tiling at an estimated cost of $500.00. The well and water system needed repairs. There was one 40-acre field that was badly spotted with field bindweed, and it was estimated that at least $400.00 would be required to eradicate it. The figures, when summed up, showed that, even though Farm No. 2 could be bought for $8,000 as compared to $10,000 for farm No. 1, the actual cost of the properties, when both were put in about the same condition, was substantially more in the case of farm No. 2. Here are the figures:

	Farm No. 1	Farm No. 2
First cost	$10,000	$ 8,000
Building repairs, house	....	200
barn	....	500
other buildings	....	150
Drainage	....	500
Fencing and repairs	....	500
Well and water system repairs	....	100
Weed eradication	....	400
Total cost	$10,000	$10,350

The down payment required in each case was $3,500. That was all the funds available to the buyer for a down payment. If he had bought farm No. 2, he would have had no money left with which to make improvements and could not have borrowed it advantageously. In the case of farm No. 1, all these improvements were included in the purchase price and financed on the more favorable basis of a real estate loan. The farmer decided to buy farm No. 1. On farm No. 2, most of the needed improvements would have been long delayed, due to lack of funds. As a result, the income would have been substantially less than on farm No. 1 because of poor drainage, weedy land, and lack of fencing. As a result, the $4,500 unpaid balance in the case of the No. 2 farm would have been harder to pay than the $6,500 balance in the case of farm No. 1. This farmer made a wise decision when he purchased farm No. 1.

Amount of Down Payment. There is a substantial difference of opinion as to the portion of the purchase price that should be in hand for a down payment. Much depends on the certainty of crops in a given region and upon the age of the farmer. Generally speaking, a man who is 30 to 35 years of age, who has good health and is buying in a region that has hardly ever had a crop failure, might be justified in buying with a 25% down payment, particularly if the price seems to be well justified by the earning ability of the land.

In regions where crops are a bit uncertain, it is desirable to have a sufficient down payment, so that well-established lending agencies will take a first mortgage for the unpaid balance, unless the seller is willing to enter into a contract whereby the amount of the annual payments will be determined by the income from a share of the crop in excess of that needed by the operator for living and carrying on operations.

In buying a farm, it is helpful to inquire carefully into the success of previous operators. If one finds that tenants who have

farmed the place have accumulated funds for a substantial down payment on a farm or that previous purchasers have been able to pay for the place, it is reasonable to suppose that it may have the same possibilities for others. If previous operators have made no progress or have gone backwards, one is likely to receive the explanation that they were poor farmers; that all that is needed is a good farmer. You may be sure that you can supply that lack. One should be very certain, however, that a large part of the difficulty did not lie in poor soil or other deficiencies of the place. Perhaps the so-called poor farmer was just as capable as you but found he had handicaps that could not be overcome.

One should carefully set down the income that can conservatively be expected from each source. This preview should be followed by a detailed list of the probable cash outlay for interest, payments on principal, taxes, labor, purchased seed and feed, machinery repairs and upkeep, building upkeep, fencing, and family living. The more intimately one is acquainted with the farm, the more accurate are likely to be the estimates. In buying a farm on credit, one should always be on guard against assuming that there will not be a considerable number of difficulties with weather that is too dry or too wet, late and early frosts, insects, plant and animal diseases, and prices that are lower than one expected.

PROTECTING FARM INVESTMENTS

Farming is subject to many hazards and risks. These should be guarded against in every possible way. Some hazards can be guarded against by forethought and good management. Others are not under the control of the farmer, and must be guarded against as circumstances permit. Full crop yields and efficient, economical livestock production are large factors in enabling the farmer to pay his debts and gain ownership of his farm. If the selection of the farm has been wise, and good soil and a favorable climate are at the farmer's command, he can do much to avoid the penalty of low production.

Protecting Production. By providing drainage where needed, stopping incipient gulley erosion, supplying fertilizer, practicing crop rotation, controlling weeds, preparing the soil well, and using good seed, the risk of low crop yields is greatly reduced. The ravages of plant diseases, and attacks by insect pests can frequently be avoided by seed treatment and by spraying with insecticides. To provide these forms of protection lies within the

power of most farmers. To fail to provide any of these measures of crop protection is to invite low crop yields and endanger the farm income. Resulting low income may in turn result in inability to meet interest accruals and promised payments on principal. Foresight protects against such risks.

In like manner, livestock production can be freed from many of the incidental risks and net income from production increased by exercising foresight in planning carefully for adequate feed and pasture, vaccination for certain diseases, and following the best known methods of feeding and of livestock sanitation.

Most of this protection can not be purchased ready-made. It must be obtained by everyday vigilance and responsibility for the growth and well-being of the crops and livestock in which lie the debt-paying income of the farmer. Good crop and livestock management is one of the best possible forms of protection of investments available. Its best feature is that it can be gained without material cash outlay.

Protection Through Insurance. Insurance is a means of spreading risks over a group of farms or of individuals. In most localities, insurance against loss of crop by hail is available at a relatively low cost. Thus a farmer, if he chooses, may share with neighbors the loss of a crop or crops, which, if carried alone, would seriously impair his yearly income and possibly prevent the payment of urgent note or mortgage obligations. By carrying crop insurance, the risk to the individual is reduced to a small annual expense. While this expense might be saved by not carrying insurance, loss of crop might result in financial disaster on a heavily mortgaged farm.

The Federal Government, through the Agricultural Adjustment Act, during the drouth years developed insurance plans to cover either loss of crop or low yields of wheat and cotton due to drouth, hot winds, hail, or other calamity. Farmers operating in a region subject to losses from climatic disturbances should thoroughly investigate the probabilities of loss of crop, the cost of insurance against loss, and the need in each individual case of dividing the risk of loss with others.

Fire and Wind Insurance. Most farm owners carry Fire and Wind Insurance on their buildings and contents. Fewer tenants carry insurance, because they ordinarily have no investment in the buildings. They will do well, however, to carry a reasonable amount of insurance on livestock, stored grain, feed, implements, and other personal and household property. Ability of a tenant

to continue in farming after a disastrous fire often depends on the funds derived from insurance.

LIFE INSURANCE. Without going into a discussion of forms of policies or terms of insurance, farmers, and especially young farmers, who are operating under a heavy debt load, are urged to consider fully the wisdom of carrying a reasonable amount of accident and life insurance. As a means of protecting investments already made, it is a good business asset. Even more important is the wisdom of providing, in case of death, a means of livelihood to a wife and family of young children. For farmers who are heavily in debt, policies that emphasize protection, such as straight-life policies or possibly term policies are to be preferred to those that emphasize investment, such as 15 or 20-year endowment policies. Accidents are quite as common on farms as elsewhere, and coverage can usually be secured at reasonable rates. In an emergency the insurance payment may go far toward covering the expense for medical care or toward hiring extra help during temporary incapacity. One should not overlook the fact that a person protected by a life insurance policy is a better credit risk than one not protected. The initial cost may seem high and an embarrassing burden, but the policy itself may be used as collateral for small loans, saving possible recourse to chattel mortgages on livestock or crop products. The one heavily in debt needs such protection more than one whose indebtedness is less.

CHAPTER XXX

FARM MARKETING ORGANIZATIONS

Farmers plant crops and raise livestock because crop and livestock products are wanted for food and clothing. Some products of the farm may be used to make other products in industry—as linseed oil from flaxseed, plastics from soybeans, and alcohol from grains. Somebody wants them and is willing to exchange other products for them. Production, then, is for consumption, the satisfaction of human wants.

The pioneer farmer produced crops and livestock products which he and his family could use in order to live. He had to depend on his own production for the essential needs of his family. He produced wheat which he ground into coarse flour that his wife baked into bread. At first he depended on game and fish for meat, keeping cows to produce milk. Eventually he butchered cattle and hogs for meat, and raised sheep to produce wool to make clothes for the family. The pioneer family was self-sufficient.

Soon, however, he was producing more of those goods than he needed for his own use—he had a surplus to sell; but he still had wants he could not supply. He wanted coffee, tea, pepper, and other groceries. He could grow only those crops that were adapted to the climatic conditions of the area in which he lived and to the nature of the soil which he tilled.

Today, all over the world, a great variety of desirable goods is being produced. In our own country we have the Dairy Belt, the Corn Belt, the Cotton Belt, so named because each area has a natural advantage in the production of dairy products or corn or cotton. Dairy products can be produced in the Cotton Belt. Cotton can be grown in the Dairy Belt under greenhouse conditions but at a disadvantage and higher cost. Crops are produced at lowest cost when climate, natural resources such as soil minerals, water power, and labor supply offer the greatest advantage to their production at the least disadvantage. This is the law of natural advantage. From all parts of the world, also, our own products are supplemented with almost endless commodities which can not be produced in our own country.

Along with natural advantage, specialized effort makes economic or low-cost production possible. Farmers produce crops and livestock suited to their farms and to their farming areas and to their individual ability or likes to produce them. Some farmers are said to be good dairymen or good crop men or good hog men, and, because of their ability, specialize in the production of such products. Specialization in industry has gone much further, resulting in highly efficient and low-cost production. The packing industry is an excellent example of specialization or division of labor where each workman does a certain job until he has developed extreme proficiency in it. An assembly of such specialized workmen makes the entire plant highly efficient, resulting in low-cost production. The automobile industry is a similar example of specialization, resulting in the production of an enormous number of cars at a price that consumers can afford. Contrast with this picture the attempt of one person to build an entire car by himself. It is said that it would take 12 years to complete it at a cost of $17,000 and then it would be a 12-year-old model.

Farmers and industry are producing a wealth of goods far beyond their own needs, but available for use by others engaged in other specialized production, so that there is an abundance of goods not only for ourselves but for world-wide consumption. As many goods are produced at a distance from where they are used or consumed, large industries require great numbers of laborers and a concentration of population in many cities. The producers are separated from the consumers of their products, and, therefore, communication and transportation are involved, since the products must be brought to the consumers when and where they want them.

The production of this wealth of goods by farmers and industry, at widely separated places, would be needless if there were no device to make the exchange of goods possible. If goods can not be exchanged they will not be produced. The Indian bartered or traded furs for guns, ammunition, and tobacco. A stack of beaver skins as high as the length of a rifle was regarded as the exchange value of the rifle. A cow could be traded for 6 pigs, in which case the exchange value of the cow would be 6 pigs, and the value of a pig would be 1/6 of a cow. Obviously such a system is impossible today, but it is still necessary to determine exchange value and measure it in some medium of exchange. The Indians used wampum or beads for this purpose.

We use money (dollars and cents) as a common denominator of value. The exchange value is determined in terms of dollars and cents which we call price.

Thus we have a wealth of goods of all kinds produced by farmers and others under highly specialized processes operating under natural advantage to bring forth a mass of production at low cost—all made possible by a system of exchange of products.

The problem is to study ways of distribution and exchange of goods among widely separated producers and consumers, so that the wants of all may be satisfied as completely as possible. Marketing is the device that makes this exchange possible.

WHAT IS A FARM MARKET?

(A market may be defined as a place where buyers and sellers meet, and where goods are bought and sold.) In this sense, it might be a farmer's roadside stand, a market square in his local village, a creamery, an elevator, or a livestock yard. In a broader sense, but still in a place, a market may be located in a distant city in such a place as the grain exchange building, the stock yards, at a terminal livestock market, or a produce exchange where farm products from a large area are sold. In a still broader sense, it may be at a world center where goods coming from many countries are sold and their exchange made possible. Liverpool used to be the world market center for wheat, because more wheat was sold there than anywhere else. At present, Chicago is the world center for wheat sales. This definition of a market as a place does not describe a market completely, because it does not explain who buys there or how the farmer is represented in the sales.

A market may also be defined as a number of jobs that must be done to bring the farmers' products to the consumer of those products. This collection of jobs is made up of hauling, buying, selling, sorting, grading, and processing the products as they come from the farm and then distributing the finished products through wholesalers, jobbers, and retailers to the consumers for whom they were produced. The job may be simple, as when a farmer sells his milk, eggs, fruit, and vegetables direct to a consumer who stops at the farm or who lives in a neighboring village or city. In such cases the farmer performs the entire job of marketing himself. The bulk of farm products is not marketed in this simple manner and must pass through many hands before it reaches the consumer. This description of the job of marketing

will be discussed in more detail in the section on the functions of a market.

Finally, a market may be defined as the result of a series of conditions or forces that influence and determine prices of farm products. The market is described as weak, steady, or strong. depending upon whether the price is going down, is stationary, or is going up. The farmer with grain to sell calls the elevator to ascertain the condition of the market before he decides whether to sell now or to wait for a rise in price. The factors affecting price will be considered in the section dealing with market price.

A market then may be defined as, (1) a place where goods are bought and sold; (2) a collection of jobs that make the sale of farmers' products possible; and (3) the result of a series of conditions and forces playing on and determining the price of farm products. The term "market" may thus have three meanings, each contributing to an intelligible picture of the overall process of the sale of farm products.

MARKET PRICE

Price is the amount of money for which a unit of any given goods may be exchanged at a given time and place. Market price is the price at which the bulk of sales is made at a given time and place, that is, it is the common or typical price. A single sale does not fix the market price, as it may be high or low, depending on particular circumstances. The market price for wheat is the price paid per bushel for the bulk of wheat bought at an elevator at a particular point for a given day and is the local market price. Local market prices are based on market prices at terminal markets when sales from a large area are made and are lower than terminal prices by the cost of handling and transportation to the terminal market. Terminal market prices in turn are based on the market prices of finished products as flour, meat, etc. Market prices of farm products at terminal markets are usually quoted daily, reflecting short-time changes in the factors affecting price. The daily fluctuations in market price are usually small and move in relation to supply and demand over a longer term. This long-time price depends on crop prospects not only in this country but in other countries, on numbers of livestock on farms, on changes in consumption or purchasing power of the consumers, and on the cost of producing farm products. Changes in this long-time price level are usually gradual. Around this level, the market price of farm products fluctuates as it is influenced by supply

and demand and bargaining activities of market men.

Market prices are determined normally by the interaction of supply and demand in the market place.

Supply Defined. Supply is defined as the amount of goods a seller or sellers stand ready to offer during a given time in a given market at a given price. There is a relationship between amount and price, since, if the price is high, a larger amount is offered for sale tending to increase the supply and reduce the price. Low prices tend to reduce the supply.

The supply of farm products depends on the willingness and ability of farmers to produce. If prices for a given product are high at the time a farmer is planning his farm program, or conditions indicate that prices will be high when the product is ready for sale, he will tend to provide for an increase in production. If prices are low or prospects indicate a lower price, he will tend to reduce his production.

The present supply of farm products is made up of the products carried over from the production of previous years and the production of the current year. For example, the domestic supply of wheat for the marketing year, July 1, 1942, to July 1, 1943, was estimated at 1,524 million bushels, due to a carry-over of 620 million bushels from previous years and an indicated crop of 904 million bushels for the 1942 crop. Products from foreign countries must be considered in total world supply as a price-determining factor.

Demand Defined. Demand is defined as the quantity of goods a buyer or buyers are ready to buy at a particular price during a given time at a given place. It is made up of a desire for certain goods together with an ability and willingness to pay for them. Merely wanting goods without the means of paying for them does not constitute economic demand. People often want many more goods than they are able to buy. Ability and willingness to pay make desire and need effective in the demand as a price-determining factor. The wants and needs of people are seldom entirely satisfied everywhere, and the ability to pay for goods is usually not sufficient to buy all the goods desired. Furthermore, the more money people have to spend, the more wants and desires they are likely to develop. Likewise, a lower income tends to discourage new wants. Hence ability to pay, or purchasing power, is an essential part of demand as a price-determining factor. Conditions that affect income or purchasing power of consumers are (1) general business activity affecting the number

of people employed, (2) the number of hours worked, (3) the wages paid, making up factory payrolls. When business is good generally, farmers can sell their products at higher prices and realize larger incomes. The total of payments made to individuals make up the national income which indicates the purchasing power of the nation. How much can be sold in foreign countries is determined by the business conditions there, and the extent to which they can supply their own needs, and the crop conditions and restrictions that interfere with exchange of goods among countries.

If demand for farm products, desire or need for such products, and ability to pay for them are relatively stable and uniform, a relatively large supply of farm products results in lower prices, while a relative scarcity or short supply of them results in higher prices. Higher prices stimulate increased production, thus increasing supply relative to demand. Lowering prices in turn tend to discourage production. The interaction of supply and demand, in relation one to the other, determines the price which tends to produce a balance between supply and demand and a tendency toward more complete satisfaction of human wants and desires.

The supply of farm products is relatively uncertain, since it depends much on climatic conditions, seasons, and biologic conditions. It appears to vary more than demand for such products and hence farm prices may be said to fluctuate more than prices for manufactured goods where production can be more nearly controlled.

FUNCTIONS OF MARKETING

A market can perform its function of disposing of farm products most satisfactorily only if the process of production has been well planned and performed. It is difficult to tell exactly where production ends and marketing begins since the farmer's program of production and choice of crops is aimed at the market for those crops. The farmer produces what he believes he can sell to the best advantage. How good a product he produces and at what cost are important factors affecting how easily he can sell, at what price, and at what net profit. He must produce what the consumer wants and is willing and able to buy. High-quality products produced at low cost sell readily at a price that can reflect profit easily. A product well produced is on the way to being well sold. No system of marketing can be devised to sell low-qual-

ity products at a satisfactory profit, especially if they are produced at high cost. Planned production, carefully executed, goes a long way to assist in the job of marketing. For practical purposes, marketing begins with the farm product as it is produced or harvested in the natural form: wheat as it comes from the thresher; vegetables and fruits as they are gathered; and livestock as it stands in the feed lot. These products on the farm are still a long way from the consumer's table in the urban center. It is the function of marketing to help the farmer to sell them and the consumer to buy them. Marketing bridges the gap between the producer and the consumer.

The various services or functions that make up marketing include assembling, sorting, grading, processing, packaging, storing, transporting, financing, and distributing. These all render a service to the farmer in selling his product and to the consumer in giving him the goods he wants when and where he wants them. Crops are frequently produced a long distance from the consumer. Wheat produced in Kansas may go to New York City. Potatoes from Idaho may be sold in Chicago and other large cities. Neither can be entirely consumed where produced. Farm products must be moved from the farm into the channels of trade in the process of reaching the consumer. Transportation is an essential function of marketing.

PROCESSING NECESSARY. Farm products as produced are usually in a raw or unfinished state and not in the form the consumer wants. Live hogs would be useless in the hands of the average consumer. Wheat is consumed as bread, not as wheat. It must be ground into flour, combined with other ingredients, and baked into bread before it is in the form the consumer wants and buys. Most farm products must be processed before the consumer will buy them.

Many farm products such as cream, butter, fresh fruits, and vegetables, if transported long distances, must be shipped in refrigerated cars and kept in cold storage until the time comes for putting them on sale—oranges, grapefruit, apples, and other major fruits are carried in cold storage over many months to prolong the season over which they are available and to avoid glutting the market at the height of the season.

STORAGE REQUIRED. Farm products must be stored on their way to the consumer. Crops are usually harvested once a year, but may be consumed daily throughout the year. The consumer does not buy a year's supply at harvest time nor can the farmer

supply the consumer daily. Wheat is stored in a granary on the farm, in the local elevator, or in the terminal elevator waiting to be milled into flour, stored as flour, and finally baked into bread for the consumer. Storing is an important factor.

Assembling and Financing. Farm products must be bought and sold in the process of marketing to make possible the assembling of volumes large enough to make up carloads or shiploads for efficient and economic transportation; to fill large elevators in quantities large enough to make storage cost less; to permit the operation of large mills or processing plants at low cost. Buyers make it possible for a farmer to sell his crop whenever he wishes, relieving him of the details of finding a consumer. They make a ready market possible. Buyers, in turn, sell, carrying the product through various processes toward the final consumer. The advertisements of sellers create demand by attracting new buyers and thus make it possible to sell more or to sell at a higher price. Buying farm products requires large sums of money which someone must furnish for periods of time necessary for transporting, storing, processing, and distributing. Financing marketing is, therefore, a necessary service. Risk of loss from fire and deterioration and decline in price during the processing also must be assumed.

Standardization. Standardization is necessary in the process of marketing to insure a uniform and dependable quality that permits purchase and sale on description by letter service, thus making personal inspection less necessary. Sorting and grading of raw products begin at the farm. State and Federal grades and standards are established and enforced by State and Federal inspection. State grades and standards apply particularly within the state while Federal grades apply to trade among states.

Packaging. Farm products finally reach the consumer in some sort of package that the consumer prefers with respect to volume, quality, grade of product, appearance, preservation of content, and price. A trade-mark and description identify the contents and give the consumer confidence in buying, if he believes he is getting dependable quality.

Distribution. Distribution refers to the processes involved in getting the finished product from the processor to the consumer. It involves wholesalers who buy large quantities for the processor, resell to jobbers, or direct to retailers.

Summary. Marketing functions may be grouped in summary roughly, (1) as those having to do with exchange, that is, buying

and selling and creating demand; (2) those affecting physical supply, as transportation, storing, and processing; and (3) those that facilitate or make easier the process of marketing, as financing, risk-taking, and standardization. These functions, efficiently performed, add utility and value to the farmer's product on its way to the consumer. The cost of such functions is included in the price the consumer pays at retail.

MARKETING COSTS

The farmer is interested in the difference, or spread, between the price he receives for his product and the price the consumer pays for the finished product at retail. He sometimes feels that he is not getting a fair share of the consumer's dollar. A number of years ago, a popular farm magazine expressed the idea in a cartoon entitled, "What happens in the dark," the dark being represented by a black area between the producer and the consumer. Another phase of the same problem is, "Who gets the consumer's dollar?" According to the Bureau of Agricultural Economics, U. S. D. A.,[1] the farmer's share of the consumer's dollar, spent for 58 foods during the period 1935-39, was 42c. The balance, or 58c, went to pay for the functions of marketing that operate between the farmer and the retailer's shelf or the consumer. The payment for these services makes up what may be termed the "cost of marketing," or "marketing margins."

All farm products require some of the marketing services, but there is a wide difference among the various products he produces. Eggs and potatoes do not require processing and reach the consumer in the same form in which they left the farm. Hogs, on the other hand, must be slaughtered and cut up into consumer-size packages, some parts cured or smoked or ground into pork sausage. Wheat must be milled into flour, mixed with other ingredients into dough, and baked. The more processes the farmer's product necessitates, the more hands it passes, the higher are the marketing costs and the smaller the farmer's share of the consumer's dollar. The efficiency with which products are handled in the marketing process is an important factor in determining marketing costs. The marketing cost may be regarded as a measure of that efficiency as well as the necessary services that need to be rendered. The farmer gets only 12c out of a dollar spent for soda crackers, but he gets 82c out of a dollar spent by the

[1] *Farm Retail Price Spreads*, Bureau of Agricultural Economics, March, 1942.

consumer for pork products. He would like to get a larger share, but he must remember that he can not perform all the marketing functions, because he is busy producing the raw materials and depends on others to perform the necessary functions for him. When he sells his milk, fruit, vegetables, and poultry products direct to the consumer at his farm or delivered at the consumer's door in the village, he gets the consumer's whole dollar. He has performed the necessary functions of sorting, grading, packaging, and transportation himself and is paid for the time required. Obviously he can not market all his products direct and must depend on others and pay them for the services they render. His problem is to find or develop a system of marketing that will sell his products most efficiently by finding the market paying the highest price per unit, according to accurate grade and function, at the lowest possible cost to reflect to him the highest net income. He must expect to pay enough for such services to enable middlemen to stay in business, but he should not have to pay more than cost of operation plus a reasonable margin of profit to provide for safe reserves. He needs to study marketing as thoroughly as he studies the production of his products, in order that he may be able to judge a marketing agency intelligently in making his choice of the most advantageous market, viewed from the standpoint of convenience, economy, and general satisfaction.

FARMERS' MARKETING PROBLEMS

The farmer faces some problems that are peculiar to the marketing of farm products. To begin with, the average farm is a relatively small-producing unit. There were over six million farms in the United States in 1940. The quantity produced on any one of them is a very small part of the total produced, and hence is comparatively insignificant in the total supply of goods offered for sale. Each farmer tends to sell his own product and sells in competition with all the other producers of the same product. Having only a small volume to sell, he has little power to bargain and must accept the price offered. His main protection is knowing what the price should be on the market where he has to sell. Since production comes from many small independent units, the products are no uniform and hence are difficult to standardize for sale in large volumes. Potato farmers may have difficulty in putting up a uniform carload of potatoes, unless they produce large acreages. They must depend on others to assemble small lots to satisfy a larger market demand.

Production Control Difficult. Farm products are the result of life and growth, and hence are subject to variations in climate and conditions necessary for such growth and production. It is, therefore, difficult to control production, since the conditions of that production are largely beyond the farmer's control. When the farmer plants his crop, he depends on rain and temperature necessary for its growth. Although he had chosen a farm with soil and usual or normal climate favorable to the crops he wished to grow, no climate is entirely dependable or free from devastating storm, frost, disease, etc. He can not halt production even though price conditions may not enable him to cover costs. He must go through with his planned production to avoid total loss. He can not control the cost of production by discharging labor, since he and his family still furnish a substantial part of the labor necessary and he and his family must live. He can not insure desirable quality of his products, since quality depends on favorable growing conditions. He can attain quality only by sorting and selection. Insect pests and diseases attack his crops and livestock and, in spite of best care and attention, they can not be entirely controlled. His livestock production depends on crops produced for feed. The farmer thus has difficulty in producing a uniform supply of uniform quality.

Transportation Necessary. The farmer is a long distance from the consumer of many of his products. Physical distance may not be greater than that of the producer of manufactured goods from his consumer, but economic distance may be greater in relation to processing and storing. Farm products must pass through more hands on their way to the consumer and, therefore, the smaller share of the consumer's dollar comes to the farmer. Direct marketing of some products is impossible.

Farmers Bear the Cost. Marketing costs are included in the price the consumer pays for the farmer's product and are deducted from the consumer's price, the balance going to the farmer as the farm price for his product. In this sense, the farmer is a residual claimant of the price paid by the consumer. The farmer does not always understand why marketing costs are so high and why the consumer pays so much more for the product than the farmer receives. He does not always appreciate the services that are rendered by these marketing functions. Advantage, at times, has been taken of farmers in assessing charges for these services. As a consequence, farmers have developed an interest in doing their own marketing through co-operative action

in carrying their products to the terminal markets and in some cases through to consumers.

CO-OPERATIVE MARKETING

During the past quarter of a century farmers' co-operative marketing agencies have increased rapidly. Beginning with the more simple functions of assembling and shipping, activities have spread to include many of the functions required in getting farm products clear through to consumers. Where soundly organized and well-managed co-operatives have succeeded in reducing the costs of marketing, they have increased the net income to farmers from products sold. Co-operative agricultural marketing organizations in many instances have forced private marketing agencies to improve their facilities and pay better prices for farm products. Those engaged in farming should give careful study to the advantages offered through co-operative marketing organizations.

THE OBJECTIVE OF CO-OPERATION. Webster defines co-operation in economic life as "the association of a number of persons for their common benefit; collective action in pursuit of common well-being, especially in some industrial or business process." In marketing farm products, co-operation is the working together of a number of farmers in performing some function or functions of marketing as a common problem to the financial advantage of each member of the group. The objective of co-operation by any group is to do together what they could not do as well as individuals. The objective of co-operation in marketing farm products is to perform the functions of marketing more efficiently and to reflect the savings made to the co-operating farmers in a higher net price at the farm. It is aimed at reducing inefficiency in the marketing of farm products. There must be an opportunity to render new or better service than is otherwise available and that will reflect a higher price to the farmer without necessarily raising the retail price to the consumers. In modern business everyone is interested in his own financial welfare and anything that contributes to an increase in his income. The farmer is no exception. He will do what he can to increase his income by more efficient marketing of his products even if he must set up his own marketing agencies when savings can be effected by so doing.

FUNCTIONS OF AGRICULTURAL CO-OPERATIVES. A co-operative is a business organization set up to do a specific job of selling

or buying. It is owned and operated by its members. Each member has one vote. It is controlled democratically, since each member has a voice in its operation. Any producer of products handled by the co-operative may become a member by buying a share of stock or paying the required membership fee. It assembles products of individual farmers and sells the combined volume of products in a market that may not be accessible to an individual farmer. It is assured of an initial dependable volume of business made up of the combined production of its members and patrons. It aims to maintain and increase that volume by efficient operation and resulting ability to pay a price as high or higher than that paid by less efficient operators with less volume. It gives each member the advantage of the bargaining power of the combined volume. The large volume attracts buyers and gives the farmer access to larger and more distant markets where more buyers are bidding. Profits or savings are paid back to the farmer in patronage dividends based on the volume of business done with it by each member or patron. Since each member has a voice in its operation, he feels that he has an active interest in it, that it is operating for his benefit, and that he gets the full market price for his products less the actual cost of operation and the reserves that need to be set aside to assure a stable financial condition. He has a share in the reserves and net worth of the organization in proportion to his contribution in the volume of business and shares bought. In short, he can feel that he has a marketing organization working for him which not only makes it easier for him to sell his products but assures him a fair price for them. Creameries, elevators, livestock shipping associations, cotton gins, egg and poultry associations, and tobacco associations are examples of local co-operatives.

Local co-operatives can, in turn, organize regional co-operatives to extend marketing functions even to the consumer. If it is an advantage for farmers to co-operate locally, it is just as reasonable to expect an advantage for co-operatives to federate. Such federations serve as wholesalers or commission companies, having the advantage of assured volume and greater economic possibilities. Thus they centralize selling and buying to increase bargaining power. Any savings are refunded to the individual farmer through his local co-operative.

Land O'Lakes Creameries is a nationally known example of such federation as are also the Farmers Union Grain Terminal Association and the Grange League Federation.

Co-operative Setup. An agricultural co-operative may be organized by a group of farmers interested in marketing a certain farm product or related farm products after they have satisfied themselves by a study of their community that such an organization is needed. Perhaps there is no local market for a particular product or such a market does not pay a satisfactory price. They have satisfied themselves that there is sufficient volume available to insure successful operation, based on the number of cows, the amount of milk produced, the number of livestock marketed, or the acres of crops produced. They are satisfied that enough farmers will join the organization. A meeting of all interested is called to discuss the matter. A vote is taken to proceed with the organization. A committee is appointed to prepare the plans under which the organization will be set up (articles of incorporation) and rules for the detailed operation of the organization (by laws), checking them with the Attorney General's office where State laws require it. An estimate is made of the amount of money needed to build a plant or to operate it, and the value of shares to be sold to members to provide the needed capital. The purpose and operation of the association is explained, that the members may be thoroughly informed. When sufficient stock has been sold, an organization meeting of stockholders is called to perfect the organization and approve the articles of incorporation and by laws. A board of directors is elected which later organizes by electing a president, vice-president, and secretary-treasurer. The articles of incorporation are signed by the directors as incorporators and filed with the Secretary of State. Legal incorporation is essential to give the association legal standing and to protect the members. The board of directors formulates the policies of operation and hires a manager to operate the business according to those policies. The association is then ready to proceed with putting the organization into operation.

Difference Between a Co-operative and a Corporation. An Agricultural Co-operative differs from a Corporation in a number of ways. The most important of these are shown in the following comparisons. Either one must be organized within the laws of the state in which it operates.

AN AGRICULTURAL CO-OPERATIVE	A CORPORATION
1. Membership open to producers of farm products upon approval of Board of Directors.	1. Membership open to investors without production but may be limited.

AN AGRICULTURAL CO-OPERATIVE—Cont'd

2. Each member has one vote regardless of number of shares owned.
3. The individual member is the unit of voting power.
4. Voting by proxy not permitted.
5. Dividends on stock limited to normal rate on money in general use.
6. Earnings above interest on stock are paid out in proportion to volume of product furnished by each patron.[1]
7. The rights of the individual member receive supreme consideration.

A CORPORATION—Cont'd

2. Each share of stock carries a vote regardless of the number of members.
3. The share of stock is the unit of voting power.
4. Voting by proxy is legal and commonly practiced.
5. Earnings on investment stock are unlimited and may be paid as dividends.
6. No provision for patronage dividends.
7. Rights are based on the amount of money invested.

LEGAL REQUIREMENTS OF A CO-OPERATIVE. Each state has its own laws relating to co-operatives within its borders. The general requirements are summed up in what is known as the Rochdale[2] principles of co-operatives which, applied to marketing co-operatives, are essentially as follows:

1. A co-operative is primarily a business enterprise. A creamery may be a co-operative—a church is not.
2. Voluntary membership.
3. Democratic control, that is, one man and one vote with no "proxy voting."
4. Distribution of savings or reserves in direct proportion to participation of member.
5. Fixed rate of interest on capital or shares of stock.
6. Religious and political neutrality.

These principles with some additions are stated in the Capper-Volstad law governing agricultural co-operatives in the United States. They are as follows:

1. A co-operative must have for its purpose the mutual benefit of its members.
2. Each member has but one vote regardless of the number of shares of stock he owns.
3. Dividends or interest or stock must not exceed 8 per cent per year. Surplus reserves distributed on basis of patronage.
4. More than 50 per cent of the total volume of business must be done with members of the co-operative.
5. Substantially all the members must be farmers.

FINANCING A CO-OPERATIVE. A co-operative marketing organization secures the necessary capital for building, equipment, and

[1] Nonmembers selling through a co-operative are entitled to patronage dividends but have no voting power.

[2] Abstract of the Laws Pertaining to Co-operatives in the U. S. and its Possessions and Territories, W. P. A., City of New York.

operation through the sale of stock or membership with voting power in the form of common stock to members. This is sometimes supplemented by the sale of investment stock, called preferred stock, to members who wish to invest money for the interest earned and to help finance the co-operative because of local interest and, when necessary, by loans from local banks, individuals, or the Bank for Co-operatives. If a co-operative, such as a livestock shipping association, does not need capital for operation, a nominal membership fee is paid as an evidence of interest and good will.

Prospective members should be thoroughly informed as to the purposes, the advantages, and the possible difficulties of the co-operative when they are being solicited for purchase of stock, in order that they may have a clear understanding of the association and the need for it as well as of the possible benefit to themselves. Co-operatives should not be oversold by extravagant promises. They should be sold on the basis of needed sound business organization and the essentials necessary to make them successful. The capital should be subscribed by many different members to insure the largest volume of business.

Purchase of a share of stock by a farmer gives him a financial stake and interest in the undertaking. If farmers are not willing to buy stock in a co-operative, it suggests that they do not recognize the need of such an association or do not understand its possibilities. Purchase of stock is evidence of the farmer's interest and sense of need, and should be regarded as an investment in a useful agency. Few co-operatives start with all the necessary capital subscribed by its members. Money needed for the balance must be borrowed from banks or individuals. Frequently too little stock is sold and too much money is borrowed. Reasonable plans for repayment of loans should be worked out and put into effect as soon as possible.

Director's Responsibilities. The board of directors of a co-operative is elected by the members at the annual meeting. It is the board's duty to direct its operation for the benefit and service of the members. The number of directors is preferably odd to avoid tie votes, but not so large as to be unwieldy. Each director should be chosen for his ability to help the co-operative operate more effectively. Business ability, honesty, and sincere interest in the job to be done are most important. Willingness to serve, while valuable, is not as important as good business ability. It must be remembered that deciding the policies or plans

for operating the co-operative for the benefit of the members is the function of the board of directors. Without a capable board, the co-operative may be expected to run into difficulties. The members have a right to expect the board of directors to assume major responsibility. Often too little thought is given to the selection of directors.

The board of directors usually meets soon after an annual meeting to organize by electing officers and appointing committees. The same person may be secretary and treasurer, if the constitution so provides. The board of directors should meet regularly, at least monthly or as often as may be necessary to keep in touch with the operation of the co-operative. It is the duty of the directors: 1. to determine the price per unit to be paid to patrons, as in creameries; 2. to review the financial and operating statements; 3. to examine accounts receivable; 4. to study reports of operations to familiarize themselves directly with the business.

In addition to attending meetings regularly, the directors should study the problems of their co-operative, in order that they not only keep up with developments in the marketing of their particular commodity but become able to anticipate probable changes and so insure an effective business unit.

Members of the board should be spread over the area served by the co-operative in order that the members or patrons of each section may be represented. Such distribution makes it easier for members to talk over individual producer problems with a board member whom they know. The directors have a responsibility, too, for keeping the members informed as to the operations of the co-operative. Members should feel free to go to a director with questions or dissatisfactions and for information and explanation.

The directors have the power to select and hire a manager and other employees to carry out the policies of the board. If the board is composed of capable men, they are likely to select a capable manager. The board can not shift all responsibility of operation to the manager, however. They must supervise and work with their manager in the actual operation of the co-operative and keep well informed about its operation.

Members' Responsibilities. Members have not discharged all their responsibilities to the co-operative when they invest money in shares of stock. They should understand why they will benefit and why they should deliver products to be sold by the

co-operative over a period of time. They may not always be satisfied but they have confidence that their co-operative will reflect the full market value less actual marketing cost and the necessary deductions for a sound reserve with which to operate. If not satisfied, they should use their right as members to go to a director or manager for an explanation. They should not stop patronizing the co-operative because of some dissatisfaction but should aim to correct and improve any fault by working through the directors or manager. Too many members think too much in terms of what price they get without considering what price they would receive if the co-operative was not in the field. Members should attend annual meetings regularly, in order that they may find out about the operation of their organization and make suggestions for its improvement. Too frequently a co-operative must furnish a free lunch to attract sufficient attendance to make a legal meeting possible. The members must think of the co-operative as belonging to them and recognize the part they must perform, if it is to be successful. The literal definition of a co-operative, as "working together," must be taken seriously with emphasis on working. Finally, there must be enough members and patrons to deliver a large enough volume on which the co-operative can depend to make it possible to operate at a low per unit cost. A creamery can manufacture butter at less cost if it handles 1,000,000 pounds of butter rather than only 100,000 pounds, because fixed costs, such as depreciation on buildings and equipment, are divided over a larger volume of product.

Responsibilities of the Manager. The duty of the manager is to operate the business of the co-operative under the direction of the board of directors. He is hired because of his ability and experience in conducting the business of marketing a given product or products successfully. To do so he must know where he can sell at the highest prices and with the least cost or expense, so as to be able to pay the producer the highest possible net returns. He must recognize quality in the product as the farmer delivers it, in order that he can pay a price in line with the quality. He must be able to gain the confidence and good will of his patrons. He must be a leader in the organization, suggesting improvements in operation, and submitting suggestions to the board of directors for decision, if it involves a question of policy or the expenditure of money. He makes decisions in keeping with the general policy. The manager comes in close contact with members and patrons and hence can do much to keep them in-

formed, especially on details of operation having to do with the product handled, with regard to grade and quality. He can answer many questions that patrons may raise and so contribute much to keeping the members informed. In short, the manager, with the directors, must so operate the co-operative as to be able to pay sufficiently high prices to meet competition and pay dividends on savings or patronage as concrete evidence of efficient operation.

Co-operative Education. Co-operatives can help develop a sense of unity among their members by holding meetings the purpose of which is to acquaint members with the business of their co-operative as well as about problems involved in the marketing of a given product. Co-operative creameries can do much to improve the quality of the finished product by demonstrating to their members how to produce higher-quality milk and cream. Quality production will be further encouraged by returning a price for such quality as will pay any added costs and some profit. Members can learn about the principles of co-operation in meetings arranged by the co-operative. By understanding the principles they will be better able to practice co-operation.

Democratic Procedure Required. To be truly co-operative, an organization must be democratic in its operation. One member and one vote assure government by the members, provided each exercises his right as a voting member. Members must be free to express criticism as well as approval at annual meetings. Election of officers should be well considered, unbiased, and free from prejudice. Questions regarding the co-operative should be encouraged and answered honestly, if confidence is to be maintained. Nominations for directors are more representative of the wishes of the members if made by secret informal ballots. If three directors are to be elected, each member may write on a nominating ballot the names of three members he favors. The informal ballots are then counted and the six (two nominations for each vacancy) names receiving the largest number of votes are considered nominated. Formal election of three directors by secret ballot should follow. This method insures more careful selection of prospective directors without embarrassment or the attributing of too much weight to an aggressive nomination. By taking active interest and part in the functioning of a co-operative, the members gain understanding of their responsibility to larger democracies such as county, state, and national government. A good co-operator is usually a good citizen.

Essentials of Co-operation. The essentials of co-operation can be grouped or summarized under five main heads, namely:

1. Economic need or opportunity to save the farmers money in marketing their products.

2. Loyal and understanding support by members.

3. Enough capital subscribed by members which, together with sound loans, will insure enough money to carry on the business effectively.

4. Efficient operation by a capable manager working with a carefully selected board of directors.

5. An accurate record of all transactions, with audits at regular periods by a disinterested trained auditor.

MARKETING GRAIN

Having produced a crop of wheat, oats, barley, flax, corn, peanuts, or soybeans, the farmer must answer the questions when, where, and how he can best sell his grain and convert it into cash. He would like to sell when the price is the highest, but he may have borrowed money which he promised to repay "when the grain is threshed." He may, therefore, be forced to sell at the same time many others are selling, when the crop will be coming to market faster than it is being used and prices are likely to go down. Wheat often sells for more in the spring than at threshing time, but the difference in price is seldom more than enough to pay for storage, handling, interest on the money invested, insurance against loss by fire, and storm risk.

Grains are usually sold to a local grain elevator, privately or co-operatively owned, that offers the highest price. The farmer watches the local newspapers for price quotations and telephones various elevators for the market price of that day. He delivers his grain at the elevator where it is weighed and samples are taken from different bags or parts of the load to get a true test of the quality of the load. A test scale is used to determine the weight of a measured bushel as a test of quality. A given weight of grain is then put through a cleaner or "kicker" that separates the clean grain from the dirt and weed seeds, and the percentage of dockage is determined. Early in the marketing season a test is also made of the moisture content to determine excess moisture as a deduction from price or to see how well the grain will store. These tests are made to determine the number of bushels of clean grain in the load, and its quality as a basis for the price to pay per bushel.

If prospects are good for a higher price later, a farmer may decide to store his grain in a local elevator, paying the usual charge per bushel per month. He receives for it a storage ticket stating the grade and amount. His grain is mixed in the elevator with grain of the same grade and he may claim the same number of bushels of the same kind of grain when he desires to sell.

The elevator can not store all the grain it buys for storage and in turn sells to someone who stores the grain in a terminal or large market center elevator. Grain may be stored at the terminal also at a given rate of storage per bushel. From elevators, local and terminal, the grain is sold to mills that grind the wheat and rye into flour to be sold to consumers to be made into bread.

The local elevator serving the farmer may be owned by an individual, by a terminal elevator, or a grain company operating a line of local elevators, or it may be co-operatively owned by the farmers who patronize it. An individual or a co-operative elevator depends on some commission company at the terminal market to sell the grain for it on what is called "the grain exchange." At this "exchange," samples of grain are taken from cars by licensed samplers and displayed to show the quality of grain in the car. Millers and grain dealers buy the cars of grain at the exchange on the basis of the samples.

"Futures" on grain are bought and sold in this exchange. Futures are contracts to accept or deliver grain at some time in the future. They are used by speculators who aim to buy low and sell high, making money from changes in price. Futures are used by legitimate dealers who protect or hedge their purchase or sale by a corresponding sale or purchase. An elevator manager who buys a load of wheat sells a corresponding number of bushels for delivery at some future time, thereby protecting himself from a decline in price. The operation of "future markets" makes it possible to shift the risk of price changes to speculators and tends to stabilize market or daily prices.

Co-operative elevators may join together to operate their own terminal elevator, with the view of extending the market to the consumer. The co-operative terminal thus represents the local co-operative in the sale of grains in the interest of the member of the co-operative. Such local and terminal co-operative elevators give competition to privately owned concerns and tend to narrow the margins charged for marketing service. Through this grain-marketing organization a farmer can sell a large or small lot of grain to reach the market whenever the grain is needed.

MARKETING FARM LIVESTOCK

Livestock may be sold to a local butcher who slaughters it and sells it over the counter to his customers. The butcher performs all the functions of marketing and gets the entire margin between what he pays the farmer and what he receives from his customers. Only a very small proportion of the farmer's livestock is sold in that way. Most of it must go to small packing houses located where a lot of livestock is produced or to packing plants at large central terminal livestock markets.

SHIPPING ASSOCIATIONS. Before the development of hard-surfaced roads and trucks, farmers had to depend on railroads to get their livestock to the market. Very few farmers had enough livestock to fill a stock car and had to sell to local buyers who assembled the stock into car lots for shipment to market, frequently taking advantage of the farmer by not paying full local value. To overcome this disadvantage farmers organized co-operative livestock shipping associations to assemble and ship livestock in carload lots. Each farmer's stock is "branded" with paint or "clipped" marks and sold separately at the market. This gives the individual farmer access to the terminal market. Shipping days are advertised and farmers bring in their livestock to be weighed, branded, listed, loaded, and shipped by the manager to some commission company or the terminal market to be sold to packers, feeders, or others. Each farmer's livestock is sold separately and a complete itemized account of sales is sent back to the manager with a check for the total shipment, less expenses incurred, such as freight, yardage, feed, insurance, commission charges, etc. From the account sales the manager can tell each shipper the price at which his stock sold. Local expenses for managers' commission, lumber, nails, rope, feed, hay and a deduction for a reserve or sinking fund are added to the terminal expense and prorated on the basis of live-weight, thus allocating the expense equitably to each shipper.

Terminal co-operative commission companies are organized at most terminal markets to handle the shipments from local shipping associations, enabling individual shippers to make savings on commission charges. By handling a larger volume of business it is possible to attract more buyers and perhaps get a somewhat higher price for their patrons. The savings or commissions are prorated back through the local association to the individual shippers.

Trucking to Market. With the construction of hard roads and the general use of trucks, farmers no longer need to ship by rail carload lots, and hence need not feel the urgent need of shipping associations. With the coming of the truck, farmers can now haul their own livestock to market in their own trucks or telephone a local trucker to pick up a calf or a truckload of stock and take it to market. Farmers depend on truckers not only to transport livestock but also to sell it. As a result, shipping associations have declined in numbers and in volume of livestock handled and farmers are drifting back to greater dependence on local buyers and truckers, and losing control of their local marketing association and weakening their terminal commission company by lack of support.

Direct Buying. The development of livestock trucking was accompanied by the practice of marketing livestock direct at feed lots to packers without going through the terminal markets. The location of "interior" packing plants in areas of dense livestock population, particularly hogs, encouraged this practice. Some marketing services rendered at terminal markets can be saved by selling direct, and hence there is a smaller marketing margin to deduct from the market price in arriving at the price paid the farmer. Livestock produced near a packing plant does not need to be hauled as far as would be necessary if all livestock went to the terminal market to be sold and shipped out to packers. Commissions on sales, yardage, and feed are eliminated in direct marketing. On the other hand, the question remains to be answered whether the complete services at the terminal market and keener competition may not secure a higher market price and, hence, even after all deductions are paid, reflect a higher net price to the farmer. By selling his livestock direct, the farmer loses the advantage of the bargaining power of larger volume handled by a shipping association or a co-operative commission company. He could retain such advantage, however, by selling through a co-operative agency that has bargaining power and ships direct to the packer, saving on a shorter haul, yardage, and feed.

Concentration Yards. Co-operative concentration yards as livestock marketing agencies are in operation in some states. They employ a trained manager who can afford to keep in touch with the various markets, can interpret quoted prices, and identify market grades. He represents the farmer and serves him as a market adviser on when and where to sell, and as to price to

expect. The large volume necessary to make a living for a full-time manager may permit sorting and grading of hogs into car or truck lots and selling "on order" or over the telephone, saving some selling expense thereby.

Direct marketing of livestock is here to stay and farmers and their co-operative livestock marketing agencies must adapt themselves to this situation, taking advantage of all possible economies but maintaining the bargaining power necessary to insure them a fair market price for their livestock.

The buyers and sellers on the provision market determine the prices to be paid for food as a finished product. The price of meat on this market is the basis for market price of the raw materials, hogs, cattle, and sheep, from which meat products are processed. The price of meats ready for the retailer is an important factor in determining what the price of the live animals shall be, together with the number of animals actually on the market, or ready for market, and the number and eagerness of buyers bidding for such numbers. Thus the wants of the consumer for meat with the necessary purchasing power are reflected through the retailer, the wholesaler, to the packer and finally to the farmer and his livestock.

MARKETING DAIRY PRODUCTS

Milk is marketed as liquid milk, raw or pasteurized or manufactured into a variety of products, such as butter, cheese, evaporated or condensed milk, dry milk powder, and casein. The process of marketing may be simple, as when a dairy farmer bottles the milk and delivers it himself to the consumer that comes to his farm or who lives in the nearby village or city. In that case, he performs all marketing services and receives all the money paid by the consumer. But only a small proportion of milk is marketed so directly. Near the larger cities the farmers sell their milk to a milk-distributing plant that standardizes, pasteurizes, and bottles the milk and delivers it to the consumer on regularly supplied routes. There may be more milk distributors selling milk in that way in some localities than is necessary to serve the consumers adequately, with the result that the cost of distribution is unnecessarily high.

In still larger urban areas, the farmers may sell their milk through a co-operative bargaining association. This association represents its farmer-members in the area in dealing with the milk distributing companies that actually deliver the milk. Such

an association enables the farmers to bargain with the distributors more effectively as to price. Such a bargaining association may not be able to sell all its milk as whole milk and manufactures the balance into products, such as butter, cheese, or condensed milk, that will pay the best price for milk to the individual farmer.

The price paid for milk is determined on the basis of butterfat content in the milk, since butterfat is perhaps the most important single milk product. Milk solids can be expected to receive more consideration than in the past because of their now recognized nutritive value. The price paid for butterfat sold in whole milk tends to be higher by the added value of the milk solids and the extra cost incurred in maintaining high quality. Competition from farmers outside ready to sell whole milk tends to keep whole milk prices in line.

BUTTER MARKETING. About one half of the milk produced in the United States is manufactured into butter. Most of this milk is separated and the cream delivered to local creameries to be made into butter. In some states, about three fourths of the butter manufactured comes from co-operative creameries. Farmers used to deliver whole milk to be separated at the creamery. Now home cream separators are used and the skimmilk is fed to hogs, calves, and chickens, at a saving of some hauling. The cream is delivered at the creamery by farmers or picked up by trucks on regular routes, the cost of hauling being paid by the farmer. With the increased use of skimmilk in the manufacture of human foods, more whole milk is sold from farms.

Farmers originally sold their dairy products as butter, churned on the farms. It was sold at local stores and resold to patrons of the stores. Its quality varied widely and the price was fixed largely by the value of the low-quality butter. With the coming of creameries, and especially the co-operative creameries, the butter is manufactured by trained buttermakers in large enough quantities to be shipped to larger markets. It commands a higher price because of its uniformly higher quality. This higher price stimulates dairy production. Paying more for sweet cream encourages taking better care of the cream and results in further improvement in quality and a higher price. The co-operative creameries can claim no small share of credit for the development of the present dairy industry.

CO-OPERATIVE CREAMERIES. The Co-operative creameries have the usual co-operative setup, but require more capital, because

their operations involve the use of a building and necessary equipment. Hence shares of stock must be sold and an association organized. The board of directors hires a trained operator who may also act as manager. The member patrons deliver their milk or cream regularly as often as is necessary to insure good quality. The milk or cream is weighed, and a sample is taken to be tested for percentage of butterfat, and the weight of cream or milk is recorded for each delivery. Payment may be made for each lot on the basis of the butterfat test, but more frequently payment is made at the end of the month at a price determined by the board of directors and operator-manager and is based on sales made. The samples of milk taken are saved by use of a preservative and the composite samples tested at the middle and end of each month. The total weight multiplied by the average or composite percentage of butterfat gives the total amount of butterfat delivered that month. The number of pounds of butterfat multiplied by the average price of butterfat gives the total payment to the farmer. The price of butterfat is based on the price of 92-score butter at New York. Surplus income in excess of necessary operating costs and reserves may be prorated as a patronage dividend to the patrons at the end of the year. The farmer thus receives the full market value of his product, less actual cost of manufacturing and operation and deduction for reserves.

Local creameries depend on butter brokers or commission-men in more distant consumer markets to find an outlet for their product. A charge is made for finding a market. Chain stores serve as outlets for butter through the stores in their system. One agency buys the butter for the entire chain from individual creameries, eliminating some handling charges and tending to shorten the way from the producer to the consumer, by narrowing the marketing margin of costs between them.

Some co-operative creameries have organized selling agencies of their own to represent them in distant markets. Land O' Lakes Creameries, Inc., is an example of such an organization. This organization sells not only butter and other dairy products for its member creameries but poultry and poultry products. Creamery and farm supplies are also handled. By placing emphasis on quality it has succeeded in improving the quality of the products handled. By an extensive advertising program, it has made sweet-cream butter popular enough to increase the demand for it at a higher price.

Other Forms of Sale. Ice cream factories offer a special market for high-quality dairy products either locally or in large consumer centers. Cheese factories are markets for whole milk but are of relatively minor importance, since cheese is not a large item in the national diet. Fresh, clean milk is necessary in making a high-quality cheese. A strong demand for butter has discouraged the expansion of cheese manufacture. An increasing volume of condensed and evaporated milk is required for use in the manufacture of candy and confections. The use of dried milk, either whole or skimmed, has increased very rapidly as a result of the recent war because of ease of storage and transportation for export to the United Nations. Its domestic use is limited as yet but has definite possibilities of expansion when it is put up in consumer-size packages. In this form, it may become a definite competitor of whole milk.

MARKETING POULTRY PRODUCTS

Poultry products, particularly eggs, require relatively little or no processing beyond that necessary to maintain the original quality of the products. Eggs deteriorate rapidly unless carefully handled. Heat encourages incubation and hastens the breaking down of the contents of the egg. Emphasis is placed by the consumer on fresh eggs. To preserve their freshness, eggs should be gathered several times a day, especially during the heat of summer and placed in a cool and fairly dry place away from objectionable odors. Care of eggs begins at the farm and must be followed rigorously until they reach the consumer to maintain the quality that commands a fair price. They should be graded as to quality, size, and color of shell, in order to supply the buyers or consumers with an attractive quality for which they are willing to pay a good price.

Most farm eggs are first sold locally to a store, produce house, or poultry co-operative. Some creameries handle eggs as a side line. They may be candled to determine the condition of the contents of the egg and graded. Sometimes they are sold "case-run" and are candled and graded later. Since eggs may vary widely as to size and quality, the farmer should be paid on a grade basis to encourage the production and marketing of eggs of high quality. Artificial refrigeration should be provided constantly to preserve the original quality at all stages of the process of marketing.

From the local market, eggs move to large centers where

they are handled by brokers, commissionmen, or at egg auctions to be sold to distributors as fresh eggs. They move by refrigerated transport, either express, fast freight, or transport trucks, in order that the least time possible be spent in transit. Egg auctions are operated in some of the larger consuming centers where lots of eggs are sold to the highest bidder. Shipments of eggs are recognized and identified with quality or the lack of it, and bids are made accordingly. Some auctions operate on a co-operative basis and represent the producer's or shipper's interest in a co-operative.

CO-OPERATIVE EGG MARKETS. Some large egg and poultry marketing associations have been organized in areas where poultry production is an important enterprise. They are composed of local co-operatives that assemble eggs locally, ship to the central organization where eggs are more carefully candled and graded, and finally sent to large consumer centers to be distributed to the consumers. These central marketing associations have been able to overcome the disadvantage of distance from the market by efficient operation and, by putting out carefully graded and standardized eggs, they are able to compete successfully with producers and agencies more favorably located.

EGG STORAGE. Eggs are produced seasonally. More are produced during the spring and early summer. Production is becoming more uniform, however, as more emphasis is placed on commercial production. Eggs, nevertheless, must still be stored from periods of heavy production for sale during periods of low production. Eggs are put into storage in largest numbers during the spring months. Storage facilities generally are well filled by August 1. Use of the stored eggs begins in late August, and continues on through the fall and winter. By March 1, the low point in numbers of stored eggs is reached.

Storage is an important marketing function and tends to stabilize prices. Without it, eggs would be still lower in spring and early summer, and still higher in the fall and winter. To facilitate marketing and storage, eggs are broken and the contents frozen in cans in increasing quantities. In this form they take up less space and result in less loss through breakage, evaporation, and general deterioration and are more convenient to use in baking and similar use. Egg powder, made by drying or dehydrating, is becoming increasingly important. Special impetus was given this practice by the recent war. A skillful cook can use egg powder successfully in place of eggs, except in serving

poached or boiled eggs. Increased domestic use of egg powder is probable.

Poultry Meat. Poultry takes the form of meat on the consumer's table. It consists of the various forms of fowl, such as chickens, ducks, geese, and turkeys. It follows the same general marketing processes as eggs. The farmer may sell his poultry direct to a local consumer, but generally to a local buyer or co-operative. Poultry may be killed and dressed in local dressing plants or trucked in crates or shipped in special poultry railroad cars to some central dressing plant. At the dressing plant it is sorted and thin birds are put into batteries and fed fattening rations to put on the desired finish. When slaughtered, the birds are graded as to quality, weight, and sex, packed in boxes or barrels and shipped in refrigeration to consumer markets. Here they are handled by brokers or commissionmen who sell them to distributors who place them in retail stores. Quality and finish are important factors in getting good prices.

Poultry dressing plants are operated by individual corporations and co-operatives and render a marketing service not only to producers but to consumers. Central co-operative marketing associations handle both eggs and poultry, and are owned and controlled by local co-operatives. These large plants have sufficient volume to make possible efficient operation and a volume that attracts buyers in sufficient numbers to be a factor in determining the price paid. Some find it profitable to process and can the dressed poultry.

Turkeys are becoming more important as a class of poultry. They are consumed most heavily during the holiday seasons of Thanksgiving and Christmas, and production is, therefore, aimed at these two markets, but more and more turkeys are stored in refrigerators, making them available during the entire year. The development of a breed of smaller, earlier-maturing turkeys will make possible the marketing of fresh turkeys throughout the year and hence may increase the demand.

MARKETING COTTON

Most of the cotton crop is sold as soon as it is picked, especially if produced by small producers. Many small producers are share croppers dependent on store credit for the supplies for the production year. As soon as the cotton is picked it is ginned and sold to satisfy their store account. Larger producers tend to store the ginned cotton and hold it for a rise in price. The cotton

is hauled from the field to the gin where the fiber is separated from the seed. The fiber is baled and stored in warehouse cotton mills. The seed is sold, the oil is extracted, and the seed residue, made into cake or meal, is sold as a concentrated protein feed to supplement livestock rations. The increased use of the oil has given the seed added value as a cotton by-product.

The ginned cotton may be sold to the operator of the gin, local merchants, local buyers, or buyers for large cotton companies, or handled through a co-operative marketing association. It is then rebaled into more compact bales and held for sale to cotton mills. Prior to 1930, about one half of our cotton was exported to foreign countries. With the decline of our foreign markets, less cotton was exported and prices declined. Government loans on cotton have since tended to fix a minimum price, thus supporting the cotton market. Cotton is sold on the basis of sample. Length of fiber or staple is an important factor in determining grades.

MARKETING TOBACCO

Tobacco is sold by individual producers to local buyers or through local co-operative marketing associations and auctions in producing areas. The price is determined by the supply and demand for the various grades in a wide variety of uses. There is no central market for the tobacco where trading would determine prices. A few large tobacco companies dominate the market. The prices of finished products are relatively stable. The price of a certain quality or brand of cigar, package of cigarets, smoking tobacco, chewing tobacco, and snuff are fairly constant. Hence buyers know what they can get for the finished product and need no marketing device to shift the burden of risk of price change.

Current supplies dependent on the year's crop are less important, since tobacco is stored to permit time for proper curing and hence several years' supply is always on hand. Producers seldom hold tobacco in their own storage but sell about as soon as the year's crop is cured. If the individual producer sells his own crop, he depends on his knowledge of the grade of his tobacco and the market price as well as on his ability to bargain with the buyer. Local marketing co-operatives attempt to represent the producer in bargaining with a buyer. Large district co-operatives have been organized to represent the local co-operatives and producers in selling to large tobacco companies.

The most common method of selling tobacco is by auction. These sales are held in large warehouses, when each lot is sold separately. Sales are made very rapidly and are made to the highest bidder. The volume of tobacco to be sold must be large enough to attract several buyers to insure competition, and some assurance must be given that the quality of each lot is recognized by the buyers. The auction tends to assure competitive bidding.

MARKETING WOOL

Wool is an important by-product of the sheep enterprise. It is sold individually by the producers to local wool buyers or through local co-operative wool pools. It is sometimes consigned to district or state-wide pools for sale to wool brokers, and to woolen mills. A national co-operative wool marketing association with headquarters in Boston is an important factor in wool marketing. It is composed of state and regional co-operatives.

Farmers sell wool in the fleece as it is sheared off the sheep and "unwashed," or "in the grease." It is sold to the woolen mills on a clean or scoured basis. The wool shrinks roughly fifty per cent in the scouring process. This shrinkage is due to the elimination of wool, fat, and dirt in the process of scouring. An abundance of wool fat or yolk is desirable, but the presence of dirt and irremovable material, such as chaff from straw and burrs, is objectionable. Wool is classed as to fineness of fiber, which determines its use. Price is determined by the supply and demand for the various grades and classes.

Because of a wide range in shrinkage, wool varies in value or price and hence should be sold on a graded basis. Farmers and large producers of wool are not familiar with grades and may not be able to secure their full value. Local co-operative wool pools have been organized to attract competing buyers, and some associations have insisted on selling the wool by grade, each pool member being paid according to the grade and quality of his wool. State co-operative pools composed of individual wool producers and local pools exist in all wool-growing areas. They, in turn, are federated into a national pool to sell the wool to mills, thus representing the individual producer's interest on a national basis. Complete account of sales made for the producer not only provides an itemized statement of the grades and prices on his wool crop, but also the detailed deduction made to cover the various steps involved in marketing.

MARKETING POTATOES

Farmers sell some potatoes direct to local consumers, to local stores, and to local buyers. They also sell through local co-operative marketing associations for shipment, if grown in sufficient quantity, by truck or railroad to terminal commissionmen or brokers who in turn sell to distributors for resale to jobbers and retailers. Potatoes are perishable and can not be stored from one season to the next. The entire crop must be marketed during the current year. The consumption per capita does not change materially with changes in price. People eat about as many potatoes when prices are high as when they are low. The current supply becomes a more important factor in determining prices. When the crop is large, prices tend to decline. A short crop with high prices encourages an increase in acreage which may result in a surplus as compared with demand and low prices. Yields per acre depend on weather, mainly moisture, and hence vary widely as seasons vary. As a result, potatoes are regarded as a rather speculative crop. They are subject to diseases, such as scab, rots, and wilt, that affect their quality. Being a vegetable, they are easily bruised in the usual methods of handling during digging and marketing and may suffer in their market value. Since they grow in the ground, they may carry more or less dirt that is objectionable to the housewife. They are not always well graded as to size and quality. Farmers must be paid a price that will make grading and brushing or washing pay. The ultimate consumer must be willing to pay for quality potatoes.

Potato Storage. The farmer may store his potatoes on the farm in a cool humid basement, warehouse, or cellar. He must be able to move them out of storage when the price suits him, even in winter. As a result, potatoes are usually stored in warehouses alongside railroads where they can be loaded into heated refrigerator cars in winter and so moved into distributing channels as consumer demand dictates.

Potatoes are commonly sold to buyers who sell direct to large distributors or to commissionmen who supply jobbers and wholesalers. Local co-operative potato-marketing associations have been organized to serve as local outlets. In some states these local co-operatives have federated into state co-operative marketing associations to serve as brokers or commissionmen. Some such state associations have failed because of lack of working capital needed for operation or because the cost of operation,

due to lack of volume or inefficient operation and selling, was too high. Large deductions from the market price and lower net prices to the producers resulted. With the failure of the state co-operative, local co-operatives also ceased to operate. To be successful, agencies marketing potatoes must furnish the consumer an attractive package of potatoes of a quality and price in keeping with the price paid. Adequate state and Federal grading laws, together with fair marketing agreements among growers in areas producing similar potatoes, would be helpful in a marketing system for potatoes.

MARKETING FRUITS AND VEGETABLES

Home fruits and vegetables are usually sold fresh and are mostly consumed in their original form. Perhaps a larger proportion are sold for local consumption than of other farm products. In their own gardens and orchards farmers can usually produce a large proportion of fruits and vegetables for home use. Most of the fruits and vegetables are produced by commercial producers who have specialized in the production of these crops either for the local market or more distant population centers. Local producers sell direct from house to house, supply local stores or sell on a central produce market in larger centers. Since fruits and vegetables go more or less directly to the consumer in their original form, quality, uniformity, and package are pleasing to the consumer and maintain good will.

Near large centers, along main traveled roads, producers can sell fruits and vegetables as well as other farm products by using roadside stands. Here they receive the full price paid by the consumer and capture the marketing margin, since they perform all the necessary marketing functions. The same is true when, in municipal markets provided in larger urban centers, they sell direct to consumers. On municipal markets much of their produce is sold to retailers. Some of the produce offered there is sold to truckers who may bring produce out of season in that locality and buy in quantity for some distant market that offers an opportunity to resell. Truck buyers tend to equalize the supply of such products over a wider area, stabilize prices, and give the local producer the advantage of a wider market. They should be encouraged in this service and not hindered by barriers that obstruct such free movement.

Wholesale markets in large centers receive fruits and vegetables from all quarters of the world as well as fruits and vege-

tables produced locally. They serve important functions in making available for consumption a wider variety of products than would otherwise be possible, widening the market for all producers of fruits and vegetables. At the wholesale market, products are sold by brokers and commissionmen to wholesalers who in turn supply retailers. Fruits and vegetables are also sold there at auction to the highest bidder. This method assists in disposing of lots of products that may need to be regraded and repacked to salvage produce that comes in poor condition.

Fruits and vegetables are handled for producers by local co-operative produce associations that perform the functions of local buyers. These locals again may associate themselves in a co-operative wholesale that serves a larger area and performs the functions of brokers and commissionmen in supplying wholesalers. The large co-operative wholesalers handle a large volume and make it possible to carry on a national advertising program that increases the demand for the products handled by finding new consumers and additional outlets. They also process fruits and vegetables and create a new outlet for products that would not be disposed of fresh, and make longer storage possible.

Refrigeration in transport has made possible the movement of perishable fruits and vegetables for long distances. Refrigeration in storage has made possible the storage of fruits and vegetables and so extended the period in which they are available for consumption.

POSSIBLE IMPROVEMENTS IN MARKETING

Some general suggestions for improving the marketing of farm products might be made to insure greater efficiency of operation in order that the cost of marketing may be reduced and the net price received by the farmer increased.

Farmers might well consider more carefully the quality of products desired by the consumer. More attention might be given to the production of milk under more sanitary conditions. Consumer-size packages of farm products, such as dried milk, dried eggs, potatoes, and fruits might help to sell them to more consumers and widen the market for them. General use and acceptance of state and Federal grades would insure greater uniformity and facilitate a more accurate determination of price in relation to quality. The elimination of waste, duplication of service, narrowing the spread, or the marketing margin, between the producer and the consumer and thereby increasing the

efficiency of necessary marketing functions, would narrow marketing margins. The consolidation of volume now handled by many small relatively inefficient marketing agencies would insure volume, making efficient operation possible. Elimination of unnecessary handling and hauling would result in less duplication of service. If marketing by individuals and corporations can not be done more efficiently and at lower cost, the need for improvement becomes a greater challenge for competition from co-operative marketing associations. Co-operatives must do the job of marketing as well or better and at less cost, if they are to succeed in the field of marketing.

CHAPTER XXXI

FARM MANAGEMENT SERVICES

The quality of management determines very largely the success of a farm business. In the past there has been little specialized management in agriculture. The 1940 census reported that less than one half of one per cent of the farms were operated by hired managers. It is probable that many of these might better be termed foremen who performed considerable manual labor in addition to their managerial duties. The size of most farm units is too small to justify the employment of a full-time trained farm manager. The farm operator combines the functions of manager, financier, technician, and laborer. Too often the managerial function is sacrificed in favor of the others. Too little attention has been given to constructive long-time planning of balanced farm organizations or to operating in the light of all the technical information that is available.

The increasing commercialization and mechanization of agriculture, the growth of agricultural technique, and the increasing size of the farm business needed to provide an economic unit all tend to increase the need for more highly specialized management. The increasing number of farms owned and operated by businessmen without farm training and experience also contributes to this need. At the present time there are two general lines along which specialized managerial service for agriculture is developing. One of these is offered by public or co-operative agencies and is designed primarily to serve the operating owner or tenant. The other is of a purely commercial type designed to serve farm owners who, because of lack of time or training for actual farm operation, find it desirable to employ managerial service.

PUBLIC OR CO-OPERATIVE FARM MANAGEMENT SERVICE

For many years the United States Department of Agriculture and the state agricultural experiment stations have been conducting experimental studies of agricultural techniques. The results have been made available to farmers through agricultural bulle-

tins and farm journals and have been brought directly to the farmer through the agricultural extension service. For more than forty years research in farm management has been conducted by these agencies. With the establishment of the Federal Extension Service in 1914, farmers were offered assistance in keeping and analyzing farm records. This work grew so rapidly that eventually it became impossible for public agencies to supply farmers with the service they demanded. In 1924 Professors M. L. Mosher and H. C. M. Case of Illinois organized what was called the Farm Bureau Farm Management Service.[1] This service was designed to give individual farmers direct assistance with farm accounting and farm management problems. This work has expanded steadily until, in 1951, 3800 farmers in 59 counties in Illinois were enrolled in these services. Similar services in Iowa, Kansas, Minnesota, and Wisconsin are in successful operation.

Organization of Co-operative Service. Under the general plan of these co-operative services, groups of farmers are organized into associations, usually by extension workers, and in some cases, as in Illinois, with the help of the farm bureau. The number of members may vary from 150 to over two hundred. The farmers are represented by the farm bureau or by an organization of their own, set up for this specific purpose, working in co-operation with extension and research workers representing the state agricultural experiment stations. A farm management specialist is employed jointly by these agencies.

Each farmer who joins an association is provided with a standard farm account book. In this he keeps a record of his year's business. The farm management specialist serves as fieldman. He visits each farmer several times a year to assist him with his records and to ensure comparability and uniformity of the records. He supplements these records with additional information secured from time to time and at the end of the year checks the books for completeness and accuracy. The records are then sent to a central office at the college, where they are again checked and the results carefully analyzed. The book is then returned to the farmer, and in addition he receives a report containing a detailed analysis of his business and comparisons with the results of records from other members of the association. This general type of analysis has been discussed in Chapter XX. The fieldman goes over the analysis with each farmer, pointing out the ele-

[1] M. L. Mosher, "Thirty Years of Farm Financial and Production Records in Illinois," *Journal of Farm Economics*, Vol. XXVII, No. 1, February, 1945.

ments of weakness and strength in his farm business and formulating a program for improving his organization and his operating practices. At each visit to the farm he discusses with the farmer any management problem he may bring up. In this way the farmer has a more or less continuous access to management advice and service.

FINANCIAL SUPPORT FOR CO-OPERATIVE SERVICES. These co-operative services are supported jointly by the farmers served and by the extension and research agencies. The farmer pays an annual fee that is usually graduated according to the size of his farm. In addition to the direct service that the individual farmers receive, the records have a distinct value for research and extension purposes that fully justifies the use of public funds in this way. The average annual cost per member at the present time varies from $35 to $50 per year. The proportion paid by the farmer varies from less than one-half to eighty per cent or more.

RESULTS AND ADAPTATION OF CO-OPERATIVE SERVICES. The continued growth of these co-operative farm management services indicates that farmers find them a valuable aid in management. It is difficult to measure the results objectively. Mosher and Case estimate that "of the 57 farmers (who were members of a co-operative farm management service for a ten-year period) the 10 who made the most improvement in earnings compared with the average of the group during the 10 years from 1925 to 1934, earned approximately $1,500 a year more at the end of the period than they would have earned had they continued to farm throughout the period as they did during the first three years of the period. These improvements in earnings were due very largely to changes in organization and operation of the farm developed out of the experience and records of the Bureau Farm Management Service."[1] Similar testimony is available from other states. This type of organization enables the individual farm operator to obtain not only a farm accounting service but also management service at a moderate cost. It is another illustration of how farmers through co-operative effort have succeeded in offsetting some of the disadvantages that result from the relatively small size of the individual farm unit.

OTHER PUBLIC MANAGEMENT SERVICES. The assistance given to farmers individually or in groups through extension work in

[1] M. L. Mosher and H. C. M. Case, "Farm Practices and Their Effect on Earnings," *Illinois Agricultural Experiment Station Bulletin 444*, 1938.

farm management has already been mentioned. This follows the same pattern as that of the co-operative associations, but in most cases the amount of service to individuals is much less than that given to association members. The Farmers Home Administration of the United States Department of Agriculture supplies its borrowers with accounting service and assistance in management. The Soil Conservation Service also assists farmers with their management problems, and in some cases with their farm accounts as well. These services are free to farmers. The Tennessee Valley Authority supplies its phosphate-test demonstration co-operators with both accounting and farm planning services. A nominal fee is paid by the farmer to cover a part of the cost of the service. Some of the large farm loan agencies, both public and private, have supplied more or less management service for the tenants on their foreclosed properties. The Agricultural Adjustment Agency has given farmers considerable assistance with their farm plans, both from the standpoint of promoting a soil-conserving plan of operation and of adjusting the cropping system to meet national needs for farm products. All of these agencies have made distinct contributions to better farm management, and farmers generally would find it profitable to take advantage of this assistance wherever it is available.

COMMERCIAL FARM MANAGEMENT SERVICES

The development of purely commercial farm management services has been under way for the past 30 years. In contrast to the public or co-operative services which work mainly with the individual farm operators, the clientele of commercial agencies consists largely of landowners and landlords whose primary business is not farming and who handle their land only indirectly through hired help or tenants. A steady increase in non-farmer ownership of land has opened up a large field for this type of service.

The following types of management are offered by commercial farm management services:

1. Management of permanently owned properties.
2. Liquidation management of foreclosed or sale properties.
3. Management of farm holdings for trust companies and estates.
4. Farm accounting and income tax service.
5. Preparing special management plans or programs to be carried out by others.

6. Consultation on farm management problems dealing with crops, livestock, drainage, erosion, equipment, buildings, and marketing.
7. Farm appraisal.
8. Sale and purchase of farms.

The management program may include:

1. Securing a tenant and drawing up the lease contract or employing the foreman and hired workers.
2. Planning the physical layout of the farm and recommending additions, repairs, and other improvements.
3. Determining the cropping system, the varieties of crops to be used, soil treatment, and general cropping practices.
4. Determining and selecting the amount and kinds of livestock and the general livestock program.
5. Current supervision of tenant or workers during the year.
6. Purchasing supplies and selling products.
7. Keeping farm records and reporting at regular intervals to the farm owner.

The fee charged for commercial farm management service varies with the amount of service rendered. It may be a "lump sum" annual payment, a flat charge per acre, a percentage of the gross or net income, or some combination of these. Most of the men engaged in this work have a considerable background of training and experience and are capable of a high quality of professional management. The size of the services varies from a one-man setup operating in a limited territory to large organizations that maintain offices and operate in a considerable number of states. The characteristic type is the smaller organization with only a few employees operating within a limited territory. This type of service fits the needs of those farm owners who lack the time or the training to manage their own properties. It is especially valuable to absentee owners who have limited opportunity to visit their farms. It is also valuable to the tenant on the commercially supervised farm, since he too shares in the results of better management. It is one more way of making skilled management available to individual farm units by spreading the services of a professional manager over a number of farms and thus reducing the cost to a reasonable level. An expansion in the use of the farm management services described in this chapter should result in increased returns for the farm operator and the farm owner and in a more efficient and better-balanced agriculture.

✓CHAPTER XXXII

PLANNED PRODUCTION PROGRAMS

In colonial days inadequate agricultural production was one of the problems with which the new settlers had to contend. At that time the concern was not what to do with products that were not needed, but, rather, how enough products could be produced. In that early day, production methods were very crude and most operations required a great deal of labor. Much of the land had to be cleared before crops could be grown, and each family could cultivate only a small acreage, because most operations were done by hand.

As the population moved westward into the prairie areas, rapid expansion in agricultural production followed. Clearing the land was not difficult; the soil was fertile; and the development of machinery made a rapid increase in production possible. Even with a rapid increase in population and great expansion in industrialization, there was no question what to do with the great quantities of wheat, pork, beef, and cotton that the American farmers were pouring into channels of trade. Foreign countries were willing and able to buy most of that which was not needed in this country. Early in the twentieth century, however, a combination of national and world forces seemed to move together, resulting in distress periods for agriculture, developing later into a general economic depression. It was then that attention was directed toward the need for a nationally organized and planned program for agriculture, aimed toward the development of stability in the industry. This effort culminated in Federal legislation that provided for a reduction of surpluses, support to market prices, shifts in production, and promoting the conservation of soil fertility.

PRODUCTION PROBLEMS OF THE FARMER

Some products of the soil are ready for consumption as soon as produced; others must be processed or converted into more usable or more desirable forms to satisfy human needs. Garden crops, for instance, are immediately edible or can easily be made ready for human use. Forage crops, on the other hand, are fed

to livestock, producing meat or milk that is a readily usable end product. Cotton or flax fiber must undergo certain preparatory processes before it can be made into cloth.

FAMILY NEEDS. Before the development of present-day technical methods of production each farm family found it necessary to depend on the farm for most of its needs. Various kinds of foods were produced, some of which required special handling in order to preserve them for consumption when needed. Shelter was improvised in wooded areas by hewing logs into proper length and shape and putting them in place. In prairie areas the walls of houses and other buildings were built from the sod covering the surface of the land. It was largely a matter of applying labor and native ingenuity to the materials available.

As the mechanical skills became more common and transportation provided a greater opportunity for exchange of goods, particularly those which were manufactured, rural people ceased to depend entirely on the farm for all their needs. Instead, they could buy in finished form many, if not most, of the necessities. With progress in the commercial skills, an increasing number of necessities and luxuries became available to most residents of the land. Production programs for individual farmers had become somewhat more simplified, because they could then grow the products to which their farm was best adapted, sell them, and buy many articles that they previously had to grow and process or go without.

FEEDS FOR LIVESTOCK. In planning a production program for most farms, consideration is usually given to the choice of crops which will best meet the feed requirements as to kind and amount. While a well-organized livestock program can be utilized to serve as a means of converting unmarketable roughages, it is of great importance that a cropping scheme be devised that will furnish the kinds of feeds which will develop and finish commodities for the market, rather than merely provide a subsistence ration for the animals.

Most farms depend on the breeding herds and flocks for the production of replacements and for the animals that are to be grown out and finished for sale.

To carry through a profitable livestock enterprise successfully, be it hogs, cattle, sheep, or poultry, proper emphasis must be placed on a feed supply that is: (1) suited to the requirements of the stock; (2) dependable from year to year; and (3) sufficient for the whole season's requirement, so as to avoid the

necessity of "skimping" on feed or of reducing the number of livestock. Good management gives proper recognition to a substantial feed supply of the right kind. The stability of livestock enterprises is largely dependent upon it.

PRODUCTS FOR EXCHANGE. In the early portions of this chapter, considerable emphasis was given to the point that exchange played a significant part in the economy of a farm program. It was noted, also, that exchange became a more prevalent practice as the trades, skills, and opportunities for commercial intercourse developed in importance.

And, in its broader meaning, the term "exchange" embraces all transactions wherein products are sold for a cash consideration and the money received is used to purchase goods or services that are necessary to carry on farming operations, pay debts, and maintain an appropriate living standard.

A production program on the average farm should make provision for crops, livestock or livestock products to be ready for sale when the markets offer the best price. The limitations of seasonal conditions must be reckoned with to some extent, but the farmer who is able to put a finished product on the market before the heavy run of deliveries of that commodity begins usually realizes a better price.

It is generally recognized that cash income from a variety of sources offers promise of greater average annual return. Planning for diversity of income is a significant phase of good farm management.

CONTRIBUTIONS TO NATIONAL NEEDS. The people of this nation have become increasingly dependent upon one another. Urban dwellers now are vitally affected in the event some force or emergency materially reduces total production of a certain commodity. They were not so vitally affected when each family more nearly depended upon its own labor and resources. An early frost in the fruit belt will ordinarily reduce the yield of certain fruits and make the general supply less plentiful. The grocer will then have to pay more for the supply of that fruit which is available, and the housewife will likely choose to use less for her family table, because the scarcity has enhanced the price or less costly fruits may be substituted.

Present speed of transportation and efficiency of refrigeration has greatly reduced the distance, for instance, between the California or Texas truck farm and the New York hotel dining room when measured in time necessary to span the area. These

modern methods of transportation have made it possible for many to accept as commonplace what was at one time extremely difficult or practically impossible.

The farm production methods and the results that have been gained in terms of greater quantities of highly nutritious foods, made available at nearly every town or country store in the nation, mark an important area of achievement in distribution. The nation can boast of great distances, but its people are as neighbors in a small community. Farmers can now take advantage of every opportunity to supply that which is in demand. If the price is adequate to make it a worth-while transaction, distance has been largely overcome.

National needs are now more fully met by national production. To the individual farmer that means that he is now better able to contribute to demands that were formerly often incompletely satisfied. It also means that, as the production field has expanded, competition has become more keen between areas as well as between individuals.

PRODUCTION FOR COMMUNITY NEEDS

The pioneer who settled in a new area was concerned with the problem of providing for his own immediate family needs. That circumstance constituted a rule which he was forced to adopt in the interest of self-preservation. But, as soon as joined by others who were endeavoring to establish themselves, he was usually ready to share what he had to make it possible for all to survive.

Before the development of transportation methods, people on the land attempted to provide for the requirements of those whose material needs could not be met by their own efforts. It was not always possible to provide enough, but the climatic and biological forces which occasionally joined to reduce the size of the crop would, in other seasons, co-operate to provide an abundance. In years of good yields everyone had enough—in years of short crop it was often necessary to divide.

PERISHABLE PRODUCTS. The advances in refrigeration and rapid transportation have extended the opportunity for supplying perishable products such as fruit, vegetables, milk, meat, and eggs to many people who previously were denied the privilege and benefit of many of those products. When it was not possible to transport delicate fruits and vegetables great distances, obviously the market outlet was substantially restricted. Smaller acre-

ages were needed to meet the most liberal requirements, and often quantities of certain crops went to waste when the local needs were fully satisfied. The element of perishability now plays a less important part than formerly.

With methods of distribution developed to serve more distant areas, competition in marketing now demands improvement in the quality of products. When local areas were dependent on the immediately surrounding territory for their agricultural goods, quality was recognized as desirable, but usually only the more progressive farmers endeavored to compete on that basis. Each community had a few farmers' wives, for instance, whose butter was considered most desirable. Often a small premium was paid for it at local stores, but the bulk of the farm-made butter was unsatisfactory in quality as measured by present-day standards. Each producer operated independently and was but little concerned about the quality of his own goods, much less about that of his neighbors.

Pooling of Products. It is of interest to note that, with the development of methods of rapidly moving perishable and semi-perishable products, there came a significant change in the relationship between individual producers. Shipping facilities encouraged the assembly of carload quantities as a minimum to qualify for favorable transportation rates. Local dealers established services whereby they would purchase the products from farmers, assemble them into car lots, and market at a distant point. Livestock marketing was looked upon as a somewhat mysterious and often hazardous operation, and the "cattle buyer" operated on a basis which usually yielded him a substantial profit. Farmers eventually learned that they could as well market their own livestock by assembling a sufficient quantity. Thus co-operative livestock shipping associations were formed.

Dairy farmers who had skimmed the cream from settling pans and churned it into butter discovered that through group action they could improve their technique by getting together, pooling resources, and establishing a co-operative "butter factory," or creamery. Thus, gradually the farmers were given encouragement to expand their production programs. There seemed to be no limit to market outlets and increased quantities were about the only objectives with which the aggressive farmer had to concern himself.

The Limit Is Reached. In preceding pages the discussion contains no reference to such terms as "controlled production,"

"surplus," or "quotas." As the operations on farms were largely directed toward methods by which greater quantities of wheat, corn, hogs, cattle, butter, eggs, and other products could be produced, there seemed to be little need to be concerned about what to do if more was produced than could be consumed or sold. While the prices which farmers received fluctuated considerably, it was possible to find a market at some price for all products.

TABLE LXII—CORN: ACREAGE, YIELD, PRODUCTION, SUPPLY, AND DISAPPEARANCE—1936 THROUGH 1949[1]

Year Beginning Oct. 1	Harvested Acreage	Production	Yield per Acre	Carry-over Oct. 1	Total Supply Oct. 1	Net Exports	Domestic Disappearance
	1000 acres	1000 bu.	Bu.	1000 bu.	1000 bu.	1000 bu.	1000 bu.
1936	93,020	1,505,689	16.2	175,886	1,681,575	*103,534	1,719,158
1937	93,741	2,642,978	28.2	65,655	2,708,633	137,656	2,209,121
1938	91,792	2,548,753	27.7	361,438	2,910,191	33,438	2,292,524
1939	88,279	2,580,985	29.2	583,740	3,164,725	42,718	2,433,928
1940	86,429	2,457,146	28.4	687,623	3,144,769	13,285	2,486,512
1941	85,357	2,651,889	31.1	644,677	3,296,566	19,041	2,786,445
1942	87,367	3,068,562	35.1	490,688	3,559,250	4,398	3,191,328
1943	92,060	2,965,980	32.2	384,101	3,350,081	6,309	3,112,505
1944	94,014	3,088,110	32.8	230,995	3,319,105	10,546	2,992,732
1945	88,079	2,880,933	32.7	315,310	3,196,243	19,279	3,001,964
1946	88,489	3,249,950	36.7	172,926	3,422,876	126,145	3,009,156
1947	83,932	2,383,970	28.4	285,594	2,669,564	6,091	2,535,358
1948	86,067	3,681,793	42.8	125,386	3,807,179	110,347	2,870,357
1949	87,029	3,379,436	38.5	825,306	4,204,742	105,439	3,239,576

* Net imports.

The phases of production that have been discussed were characterized by one important feature. Farmers, individually and collectively, were not able to stabilize quantity of production to correspond to needs. They produced as much as they could, marketed when they thought best, and generally continued to place what they assumed was personal interest above that of all the people engaged in the industry. The piling up of great surpluses was unavoidable in the nonperishable or semi-perishable types of products. The problems which the situation provoked were serious because the lack of an effective demand, locally and for export purposes, resulted in very low prices on products in storage as well as for the new crop of each season.

Table LXII illustrates the situation relative to corn for a 14-year period. Note the large variation in yield, total production,

[1] Feed Statistics. Statistical Bulletin 95, Bur. Agr. Econ., U.S.D.A.

carry-over, and net export. The variation in yield from year to year can be largely ascribed to climatic conditions, although the substitution of hybrid varieties has had a marked influence on the yield per acre in the later years.

PRODUCTION CONTROL PROGRAMS

The plight of agriculture during the years that followed the economic collapse of 1929 was sufficiently serious to focus national attention on the general problem; and the Federal Government, under enacted legislation, proceeded to establish machinery designed to correct the conditions which brought on the paralysis of the agricultural industry.

THE AGRICULTURAL ADJUSTMENT ADMINISTRATION. The Agricultural Adjustment Administration was established by Federal law in 1933. Its provisions prescribed an organization pattern headed in the Department of Agriculture, with the Secretary of Agriculture delegating operating functions to an administrative organization located in Washington, D. C. State and local interests were supervised by committees composed of chosen representatives of farmer co-operators.

The original A.A.A. (Agricultural Adjustment Act) provided principally for:

1. Adjustments in production of wheat, corn, cotton, hogs, rice, tobacco, and dairy products.
2. Benefit payments, derived from processing taxes and paid on a voluntary reduction contract between the government and each co-operating producer.
3. Expansion of markets, encouragement of exports, and regulation of marketing methods.

The Agricultural Adjustment Act of 1933 also required an extensive field organization to put its provisions into effect. It made necessary the promulgation of a comprehensive program of education in order that the regulations might be uniformly interpreted in all the counties and communities in the nation. This educational program was undertaken by the State Agricultural Extension Service in co-operation with the A.A.A. and the Federal Agricultural Extension Service of the United States Department of Agriculture.

Farm producers were called upon to set up the administrative machinery in each agricultural county serving as local headquarters, with townships and communities having locally elected committees to direct local phases of the program.

The validity of the Act of 1933 was challenged and the United

States Supreme Court handed down in 1936 a decision which sustained the contention that the Act was unconstitutional.[1] All activities of the A.A.A. were, therefore, immediately suspended.

Soil Conservation and Domestic Allotment Act of 1936 and 1938. In the administration of the original agricultural adjustment program, an increased interest was evidenced in the conservation of soil as a part of the national program. When it became necessary to develop a new program to take the place of the Act of 1933, agricultural leaders recommended that soil conservation be a basic principle in the new law proposed for enactment.

The general plan provided that certain crops be designated as "soil-depleting" and others as "soil-conserving." Such crops as wheat, corn, cotton, and other grain crops were included in the first category, and legumes and grasses were placed in the "soil-conserving" class. Payments were earned by co-operators by shifting to certain planned cropping programs which required usually that the acreage of soil-conserving crops be increased with a corresponding reduction in the acreage of soil-depleting crops. Additional payments might be earned by carrying out certain approved "soil-building practices."

The Agricultural Adjustment Act of 1938 was enacted to fit into previously-adopted legislation and to provide greater opportunity to meet the need for shifting production emphasis from certain specified crops to others and still retain the soil conservation features. The extent to which shifts might be made was governed largely by the national need for the respective crops and the ability of farmers to make the shifts.

The allocation of acreages of designated crops to each particular farm was determined by first adjusting the increase or decrease assigned to the state, to a county basis, and thence to each farm, using the production history of the state, county, and farm as the basic guide.

The Agricultural Adjustment Act of 1938 was a particularly important piece of legislation, as it heralded the inauguration of several new farm programs. They were:

1. Price and parity payment program to growers of certain crops.

2. Commodity loans to co-operators.

3. Marketing control of surplus crops when approved by two thirds of the producers voting.

[1] Decision of Supreme Court in the Hoosac Mills Case, 1936.

4. Freight rate investigation and study.
5. Federal crop insurance on wheat and cotton.
6. Purchase of surpluses for distribution to persons on relief.
7. Export subsidization of farm surpluses.
8. Establishment of research work to seek new uses for surplus crops.

PROPER LAND USE. Nationwide interest and concern have been greatly stimulated regarding soil conservation. Numerous instances have been revealed wherein the top soil has been lost by washing or blowing, and, generally, can not be replaced. Observation and study have also directed attention to the fact that there is much waste of soil resources as a result of improper cultural practices. Certain areas have topography or soil texture and structure which does not permit proper handling for crop growing. In other instances limited rainfall makes the growing of certain crops a hazardous enterprise, fraught with a high probability of failure to the operator. The Soil Conservation Service now organized in the United States Department of Agriculture has developed far-reaching programs for preventing loss of soil by erosion.

Organized efforts have been directed toward reducing the extent of improper land use. Individual farmers in some cases have adopted methods shaped after Federally sponsored demonstrations that were more appropriate to the soil, topography, and climate than the methods being followed. Encouragement is given also to techniques that minimize the possibility of loss through improper land use.

CO-ORDINATION OF LAND USE WITH PRODUCTION PROGRAMS. In the administration of the agricultural conservation program, particularly in allocation of quotas for certain types of crops, consideration is given to the adaptability of the area for the growing of the specific crop. On a regional or state basis, adjustments are made in the regulations to permit equitable opportunity for participation in the program through the growing of such crops and carrying on of such practices as will be conducive to maintenance of soil structure. Proper land utilization embraces the field of activity which influences all phases of soil management, and the selection of appropriate crops occupies an important place. In some farming areas where wind or water erosion constitutes a serious problem, the carrying out of control practices is recognized by granting "soil-building" payments to co-operative farmers.

To some extent the establishment of production quotas is

influenced by the adaptability of the area for the growing of the crop without unduly jeopardizing the future use of the land. There is, of course, a practical limitation to the extent to which production quotas can be changed. Obviously, no area can be expected to make extensive and abrupt shifts in types of crops except as the alternative crops have somewhat similar requirements with respect to machinery and equipment, and can otherwise be fitted into the general crop program without impairing the farm income.

NATIONAL PRODUCTION PROGRAM

The development of the national goal for any product requires the determination of certain information. The following formula will explain, in an elementary way, how the goal is established:

NATIONAL NEEDS—PRESENT STOCKS—GOAL. Under "national needs" must be included domestic requirements, export requirements, and adequate carry-over into succeeding years. "Present stocks" represents the quantity of the product which is available and which can be reckoned to reduce total requirements. The "goal" is the amount of the product which will provide for all needs and for a satisfactory carry-over in the event the goal should be reached. The national goal is broken down into state production goals, and assigned to the various states. The result may mean a reduction in effort on the part of producers or it may necessitate an increase. State quotas are determined largely on the basis of vast production records, covering several years, adjusted in some instances to compensate for situations which might cause inequity to certain states or to give desirable trends encouragement.

STATE PRODUCTION PROGRAMS. The production goals that have been assigned to states must, under the direction of a State P.M.A. Committee, be reallocated to smaller county and township units in the organization pattern. The task of administering the program in all its ramifications makes this process necessary. County quotas, or goals, are fixed after reviewing the production data for each particular crop grown in the county during a certain period. County goals, in terms of acres to be grown, anticipate a gross production and a quantity that will be available for meeting the over-all national needs after providing for local feed, food, seed, or other requirements.

COUNTY PRODUCTION PROGRAMS. At the county level the quo-

tas or goals are assigned direct to the farms by a County P.M.A. Committee. Local committees, composed principally of farmers, develop the plan for meeting the production they are called on to furnish or they lay out the restrictive requirement necessary to meet the assigned quota. The production history is again used as a guide. Crop acreages grown in past years are grouped to establish a "soil-depleting base." Yield possibilities are estimated and assigned to each farm serving as basic data in setting up a program for compliance.

In arriving at appropriate goals for each farm, the soil-conserving possibilities are given consideration, particularly where there is obvious need for special handling to prevent rapid deterioration of fertility.

Thus each participating farmer, representing an individual among many thousands of farm operators, assumes his responsibility for a part in a national undertaking, working through local, county, and state organizations to achieve collectively what is determined to be the national objective. The program contemplates an adequate supply for local needs first and for the nation and world needs when home requirements are met.

SAFEGUARDS FOR FUTURE PRODUCTION

The job of providing the nation with an ample supply of food, fuel, feed, and fiber does not end with the close of a season. As long as people have physical wants that must be satisfied, the soil must be relied upon to grow plants which can ultimately be converted into their most satisfactory form.

Reliance on the soil requires consideration of soil fertility. Soil with little or no fertility has little value, even if other requisite qualities are present. Fertility of the soil, when destroyed or removed, must be replaced. To retard the rate of depletion, then, is a practical form of fertility conservation.

In recent years considerable emphasis has been placed on the advisability of retaining the fertility inherent in soil and to increasing the plant-food content for future use. Excessive cropping and other exploitive practices have been discouraged, and constructive land management plans have been urged that place the long-time interests above the immediate expediencies.

Ever-Normal Granary. Storage of nonperishable farm products for future needs, eliminating the dumping of those products on glutted markets, is one of the important efforts of the Federal Government to stabilize prices for farm commodities. In years

when conditions have been favorable, the total crop has been greater than the normal channels of trade could absorb. Surpluses have been held on farms under commodity loan programs, and, when it has been necessary to make way for succeeding crops, storage facilities have been provided which have resulted in the building up of great stocks of wheat, cotton, corn, and certain other commodities to be held in reserve against possible reductions in new crops or to meet unforeseen foreign demands. This program of orderly storage has had a stabilizing influence on prices of such crops; it has added a sense of security to the nation through the knowledge that a calamity through crop failure is practically out of the question; and it serves as an effective method in reducing the rate of fertility depletion. The stocks of produce that have been stored for future needs represent a recognition that soil resources are to be preserved as well as to be used.

THE ECONOMIC PLAN OF THE FUTURE

The intelligent use of land is of major national concern. Agriculture, in all its various forms, will continue for a long time to be a source of livelihood for millions of families, and, because of that fact alone, its importance will likely encourage much support for national programs. Rural people must appreciate the fact that they deal with resources which are not for the present generation alone but for future generations as well. Satisfactory standards of living are not possible on farms when the soil has ceased to be productive. People may attempt to sustain themselves on land which erosion, for instance, has destroyed, but eventually abandonment results. Restoration is a long-time process as was the job which nature performed when the soil was first formed. Preservation of what remains and building for greater use are a satisfying objective, when all the elements of the undertaking are understood. To understand the factors which govern in the proper use and maintenance of the many types of soil which comprise the agricultural area is the task ahead for those who wish to serve agriculture. An exploitive plan is not conducive to satisfaction of the natural desire of most farm people—to grow living things abundantly.

THE U. S. D. A. AN AID TO FARMERS

The growing, processing, and marketing of the crops, livestock, or livestock products in various regions having peculiar soil and climatic conditions have required specialized research

work, which often could not be sustained by the relatively small number of persons thus engaged. Services that have a national application would not be provided if they depended on individual areas to furnish them. The United States Department of Agriculture is organized on a national basis with abundant facilities to provide appropriate services for the families engaged in farming. Divergent interests are not removed, but efforts are directed and inspired from a national viewpoint rather than from that of individuals or groups. The administrative head, having a seat in the President's cabinet, represents agriculture on an equal basis with other economic groups, is able to assist in planning national over-all programs, and to speak for all farmers, regardless of their localized interests and objectives.

The department is organized on a comprehensive basis, taking into full account every possible angle that affects agriculture. It is concerned with research in a multitude of fields of activity, ranging from family health and nutrition to the growing of forest products. Results of experimentation that are worthy of release are disseminated to farm families through publications and extension services. Market reports are assembled at all principal market points and made available to farm families by radio, newspaper, and letter.

Certain controls are maintained under department jurisdiction. Typical of that type of service is the plant quarantine, Federal grading services, stockyards regulation, and many others. Educational services are given partial support by the department, which include agricultural extension, vocational agricultural courses in high schools, radio programs, and publications issued by the various agencies.

The department administers a number of "action agencies" whose functions are to carry out operational programs. The A.A.A., F.C.A., F.H.A., S.C.S., C.C.C. programs are only a few of the many that have served agriculture in one manner or another. It is significant that every activity of the Department of Agriculture, when traced back to its fundamental purposes, will end in the farmer's yard. The many functions and activities are intended to serve agriculture; and the individual farmer, in many instances, can not encompass by imagination the diversity of the activities that are supported year after year to make his farm, his family, and himself contribute in the greatest degree to the national well-being.

CHAPTER XXXIII

LEGAL MATTERS RELATING TO FARM BUSINESS

Farmers, as a rule, are not much concerned with law, as they have only occasional contact with lawyers and courts. It is important, however, that they have knowledge of the legal matters that relate to farm business procedures and the current transactions of everyday farm life. The discussion following is not intended as legal advice, but is presented only with the view that it may prove helpful to those engaged in farming as a means of livelihood. It is wise, if not absolutely necessary, when buying a farm, leasing property, or transacting other business of importance to engage someone well versed in the law to examine the title and draw up the legal forms required in the transaction. The party that buys as well as the party that sells should have a clear understanding of the steps involved and of the responsibilities of each to the other. Farmers should be well informed about farm leases, real estate and chattel mortgages, promissory notes, checking accounts, and other forms of legal papers commonly used in connection with farming. Consideration will first be given to the property rights involved in buying a farm.

REAL PROPERTY. In the eyes of the law, *Real Property,* usually designated as *Real Estate,* is land or an interest in land. The term is much broader in its meaning, however, than land only. It also includes anything which is permanently attached or annexed to the land, such as buildings, wells, windmills, fences, trees, grass, or growing crops.

PERSONAL PROPERTY is everything not classed as real property, such as furniture, stored grain or hay, tools, implements, horses, cattle, and other livestock, or other movable property not definitely attached to the land. Under certain circumstances personal property may become part of the real estate, in which case such property is called a fixture or fixtures.

FIXTURES are articles of personal property which have become part of the real estate to which they are actually or constructively attached or annexed. Windmills, fences, hay carrier tracks, and similar articles are examples of fixtures.

It is sometimes difficult to determine whether or not a certain

unit of property is a fixture or whether it retains the character of personal property. For this reason many disputes come before the courts. For example, Jones, a tenant, at his own expense, on the farm he has leased builds a corncrib which he says is a temporary structure. The owner of the farm leased by Jones sold it to Brown. Brown thought the corncrib was one of the buildings of the farmstead and that he had bought it with the land. A dispute could easily arise in this statement of facts. Questions of this kind frequently arise between landlord and tenant, purchaser and seller, and mortgagors and mortgagees.

The principal test as to whether personal property becomes a fixture or not rests mainly with the intention of the parties at the time of the annexation. This intention is not merely mental, for intent alone, without actual annexation, will not convert personal property into real estate. The intention, if not expressed in writing or before witnesses by the parties concerned, will be considered from the facts in the particular case. The courts mainly consider two points in determining such questions.

1. The relationship of the person annexing the property to the real estate, whether as a tenant or an owner. If the owner annexed personal property to real estate, the intent that such should be part of the real estate is stronger than if a tenant attached such property.

2. The manner in which the personal property is annexed—can it be removed without causing material damage to the real estate?

Summarizing this brief statement on the subject of fixtures, it may be said that, if personal property becomes so attached to the real estate as to be a fixture, that property passes with the real estate when it is sold or rented.

BUYING A FARM

Under the Statute of Frauds, enacted by most states, contracts for the sale of land or any interest in land must be in writing. An oral agreement to sell land or any interest in land can not be enforced. This rule of law is a good point to follow in considering the purchase of a farm. Naturally, one must first find an owner who is willing to sell his farm on the terms that a purchaser is able to meet. When such a prospect seems favorable, one should make a complete inspection of the farm, preferably with some person whose advice is regarded sound. Some of the tests of a good farm are location in relation to churches, schools, and town,

the condition of roads, the type and condition of soil, drainage, buildings, and fences. Check also whether or not the farm is free from noxious weeds. In making this survey observe carefully any articles such as brooder houses, temporary granaries, water pipes, haying equipment in barn, or any other articles that might be questionable as to whether or not they are fixtures. The next step is to determine the amount of taxes levied against the farm. Make an inventory of these items and investigate each one thoroughly.

One is then ready to negotiate with the owner as to the purchase price and the terms of sale. The discussion should cover also the inventory of questionable items, but one is not yet ready at this point to complete the transaction, since information is needed about the rights of title possessed by the owner.

EARNEST-MONEY CONTRACT. While a check of the title is being made, a preliminary instrument in writing, known as an Earnest-Money Contract, should be executed in order to bind both seller and purchaser to any agreement that has been reached. Many persons regard the Earnest-Money Contract as merely a form and pay little or no attention to its preparation. In fact, it is the most important instrument in the entire transaction, since it is the basis for other instruments which follow, such as a Warranty Deed or a Contract for Deed, and other documents or papers related to the transaction. This is the instrument that should define the questionable items, such as the temporary granary, the hay equipment in the barn, the water pipes, electric equipment, and all other items that may be of doubtful classification.

The Earnest-Money Contract should show:

1. The correct names of the parties.
2. An accurate description of the real estate.
3. The purchase price, the manner of payment, and the rate of interest, if interest is to be paid.
4. Any special provision, such as an inventory of personal property included in sale of real estate.
5. The type of deed to be given.
6. Agreement as to furnishing a complete Abstract of Title by the seller.
7. A time limit on examination of abstract and period within which title must be made good by seller.

Also, the Earnest-Money Contract usually provides for retention, by seller, of the earnest money paid, if the purchaser fails to carry out the contract.

The Earnest-Money Contract should be signed by the seller and the purchaser, and, while it is valid as between the parties

EXHIBIT A. EARNEST-MONEY CONTRACT

EARNEST MONEY CONTRACT OF SALE

Duluth, Minn. April 15, 19 47

Received of Frank J. Brown

One Hundred and no/100 - DOLLARS, ($100.00), *as Earnest Money, and in part payment for the purchase of the following described property situated in the county of* St. Louis *and State of Minnesota, viz:*

The West Half of the Southwest Quarter of the Northeast Quarter (W½ of SW¼ of NE¼) of Section Eight (8), in Township Fifty-one (51) North of Range Thirteen (13) West of the 4th P.M., St. Louis County, Minnesota.

which I *have this day, through* Matthew J. Finley, my *authorized agent* , *sold and agreed to convey to said* Frank J. Brown *for the sum of* Two Thousand and no/100 - - - - - - - - - - - - - *Dollars, ($* 2,000.00), *on terms as follows, viz:*

One Hundred and no/100 - - - - - - - - - *Dollars ($* 100.00), *in hand paid as above, and* Nineteen Hundred and no/100 Dollars upon the execution and delivery to the buyer of

~~payable on or before the dates named above, or as soon thereafter as~~ *a Warranty Deed conveying a good title to said land* ~~is tendered,~~ *time being considered of the essence of this Contract.*

It is understood that complete abstract of title continued to date is to be furnished to purchaser at the expense of vendor , after which 5 *days is to be allowed purchaser for examination of title and report*

Such purchaser agrees to pay all taxes or assessments, or installments thereof, that may hereafter become payable on said property from date hereof, including unpaid installments of special assessments heretofore levied on said property. It is mutually agreed between the parties that the following articles are a part of the Real Estate described herein: (1) 6 portable v-type hog houses, (2) 1 temporary corncrib, 1 brooder house, all water pipes used in conducting water from the well to the barn. All rope, pulleys, and hay slings and fork now in the barn.

And it is agreed that if the title to said premises is not good and cannot be made good within sixty days from date hereof, this agreement shall be void, and the above One Hundred and no/100 - - - *Dollars ($* 100.00) *refunded. But, if the title to said premises is now good, in the name of the vendor , or is made good to him within sixty days, and said purchaser refuses to accept the same, said* One Hundred and no/100 - - - - *Dollars ($*100.00) *shall be forfeited to the vendor. But it is agreed aud understood by all parties to this agreement that said forfeiture shall in no way affect the right of either party to enforce the specific performance of this Contract.*

It is especially understood and agreed that this sale is made subject to approval by the owner of said premises in writing and that the undersigned Matthew J. Finley *agent , is in no manner liable or responsible on account of this agreement except for the return of said earnest money as herein provided.*

.... *Seal*

By.. *Agent*

I *hereby agree to purchase the said property for the price and upon the terms above mentioned, and also agree to the conditions of forfeiture and all other conditions therein expressed.*

.... *Seal*

I *the undersigned, owner of the above described land, do hereby ratify the above sale and agreement.*

.... *Seal*

if not witnessed or notarized, it is well to have such instrument properly witnessed and acknowledged by a notary or other officer eligible to take acknowledgments.

EXAMINATION OF TITLE. There should then be a careful examination of the title. The Abstract of Title should be continued by the seller to the date of sale, so that all recorded instruments affecting the title will be shown. The making or continuation of the abstract is usually done by an abstractor, a person skilled in making a search of the records. He will note whether or not any new instruments have been filed since a previous abstract was completed. The abstract is really a history book of the land. It traces the title of ownership from the first person who owned the land to the present owner. It gives a brief statement of the deeds, mortgages, liens, judgments, probate proceedings, foreclosures, and the parties named and concerned in all the instruments.

This basic information, together with a careful search of the instruments on file, will enable a lawyer, whose services the purchaser should secure, to determine whether or not the title is good. Usually the abstractor will furnish a statement concerning the unpaid taxes against the property and a judgment[1] search relative to all persons who may have had an interest in the land during a stated period. This period differs in the various states. For example, in Minnesota a judgment is effective against a person for a period of ten years and becomes a lien against all his real estate located in the county where the judgment is filed, exception being made in certain cases involving the homestead. For this reason, one will want to know whether or not former owners are free from judgment. If the services of a lawyer are secured, as they should be, he will write an opinion after he examines the title, stating the condition of the title. If the title is defective, the seller, under the terms of the Earnest-Money Contract, is required to clear such defects within a prescribed time. If title is good, the opinion will direct attention to the fact that certain matters such as mechanics' liens and interests of parties in possession, while not appearing in the abstract, may affect the title. For example, any person contributing labor and material toward the improvement of the real estate has a lien against the land for payment of the cost of such improvements. Such persons are not required to file their lien or liens immediate-

[1] A judgment results from a lawsuit between two or more parties. It is the formal declaration of the rights of the parties as determined by the trial.

EXHIBIT B. Extract From Abstract of Title

27

For Articles of Incorporation of the Woodland Company, see Book S of Miscellaneous Records, page 2.

28

150 Mtgs. Page 466	Woodland Company, Plaintiff, —Vs.— Motor Line Improvement Company, et al., Defendants.	Lis Pendens In District Court, 11th Judicial District, St. Louis County, Minnesota: Dated June 29, 1899. Filed June 29, 1899, 11 A. M. The object of this action is to declare plaintiff owner in fee of the NE¼ of Section 8, Township 51, Range 13, and other land.

29

177 Deeds Page 132	Woodland Company, —Vs.— Motor Line Improvement Company, et al.	Final Decree In District Court, 11th Judicial District, St. Louis County, Minnesota: Dated September 23, 1899. Filed September 23, 1899, 11:30 A. M. Adjudged and decreed that plaintiff is owner in fee of the NE¼ of Section 8, Township 51, Range 13, and other land.

30

305 Deeds Page 227	Woodland Company (a Wisconsin corporation) by President and Secretary (Corporate Seal) —To— C. Francis Colman.	Warranty Deed Dated July 1, 1909. Filed August 24, 1909, 11 A. M. Conveys the NE¼ of Section 8, Township 51, Range 13.

31

268 Mtgs. Page 19	C. Francis Colman, —To— Woodland Company (a Wisconsin corporation).	Mortgage Dated July 1, 1909. Filed July 14, 1909, 4:45 P. M. Consideration $1,800.00, three notes of $600.00 each, due on or before one, two, and three years, with interest at 6% payable semi-annually. Conveys the NE¼ of Section 8, Township 51, Range 13. Given for part purchase money.

CORPORATE SEAL

ly upon completion of improvements, but are given a period of time within which a written statement must be filed. The time for filing such lien, or liens, is determined by the statutes of the state wherein the land is situated. If there is evidence that work has been done recently, the seller should be asked to show paid receipts or give a surety bond indemnifying the buyer against loss suffered by any liens that may later be filed against this property. The purchaser is charged with the responsibility of making inquiry as to the interests any person or persons residing upon or in possession of the land may have. For example, the occupant may have a lease which is not filed or he may have an unrecorded deed for the land. Either of these contingencies, if actual, would affect the title and perhaps delay transfer of title and occupancy. Then, too, certain persons may have acquired, by reason of use for a long period, rights such as easements in the use of a roadway passing through the land. These are some of the problems which must be considered when entering into the purchase of real estate.

TRANSFER OF TITLE. If the title has been found to be without defect, the seller, upon payment to him as provided by the Earnest-Money Contract, will execute a deed transferring ownership. There are two types of deeds, (1) Warranty Deed and (2) Quit-Claim Deed.

There are several forms of deeds. It is necessary to note carefully the different situations covered in each form.

TYPES OF DEEDS

WARRANTY DEED. As shown in the illustration, a Warranty Deed contains the following covenants, the seller in this case being the grantor and the purchaser the grantee.

1. That the grantor owns the premises.
2. That he has good right to convey the same.
3. That the premises are free from encumbrances (except as stated).
4. That the grantee shall not be disturbed in his quiet possession of the premises by reason of any defect in the title, and
5. That the grantor will warrant and defend the grantee against eviction by anyone who may prove to have a better title.

While the covenants expressed in a Warranty Deed are definite, it is not good practice to depend wholly upon these warranties, since the financial responsibility of the party with whom one may be dealing determines whether or not he can support such declarations. Many purchasers, relying entirely upon the

Warranty Deed, fail to have the title examined by a competent examiner. The difficulty with this manner of dealing is something like "locking the barn after the horse is stolen." If the title later proves defective, there is no assurance that the grantor can be found or is able to make good his warranties. If found, he may be financially irresponsible and, in any event, a lawsuit to enforce the contract is not a pleasant undertaking and involves additional expense.

QUITCLAIM DEED. A Quitclaim Deed differs from a Warranty Deed in that it merely transfers whatever interest the grantor has in the property. It contains no covenants and makes no promises of defense of title. This is the type of deed that confidence men sometimes use in selling buildings or lands which they do not own. They transfer only their professed interest. If the title is good, however, a Quitclaim Deed will give the grantee full right to the property.

JOINT TENANCY. If the purchaser is married, consideration should be given to the manner in which the real estate is to be held. When two or more persons hold real estate, it may be held as: (1) *Joint tenants and not as tenants in common* or (2) as *tenants in common.*

Under Joint Tenancy ownership, when one of the owners dies, the survivor or survivors receive full title without the necessity of probate court proceedings. In some states the filing of a certified copy of the death certificate with the proper office in the county where the land is situated clears the title, so that it will appear in the name of the survivor or survivors. In most cases this is a desirable plan of ownership between husband and wife, particularly when the land owned is used as the seat of their home. Since the law covering joint tenancy may differ from state to state, however, it is suggested that the law of your state be examined to determine whether or not this form of deed will convey the advantages pointed out above. When real estate is held in Joint Tenancy, either one of the parties is deprived of the right to dispose of the property through a will. For example, if John Jones and William Jones, brothers, own property in Joint Tenancy, and John should make a will transferring his interest in the property to his sister, upon his death that interest would pass to his brother regardless of the will, and in that event his heirs would have no interest in the real estate.

TENANTS IN COMMON. Under this type of plural ownership each co-owner has an undivided interest in the land in proportion

EXHIBIT C. WARRANTY DEED

This Indenture, *Made this* 1st *day of* May, 19 47, *between* John J. Jones, unmarried

of the County of St. Louis *and State of* Minnesota, *part* y *of the first part, and* Frank J. Brown

of the County of St. Louis *and State of* Minnesota, *part* y *of the second part,*

Witnesseth, *That the said part* y *of the first part, in consideration of the sum of* One Dollar and other good and valuable consideration ~~Dollars,~~ *to* him *in hand paid by the said part* y *of the second part, the receipt whereof is hereby acknowledged, does hereby Grant, Bargain, Sell, and Convey unto the said part* y *of the second part,* his *heirs and assigns, Forever, all the tract or parcel of land lying and being in the County of* St. Louis *and State of Minnesota, described as follows, to-wit:*

The West Half of the Southwest Quarter of the Northeast Quarter ($W\frac{1}{2}$ of $SW\frac{1}{4}$ of $NE\frac{1}{4}$) of Section Eight (8), in Township Fifty-one (51) North of Range Thirteen (13) West of the 4th P.M., St. Louis County, Minnesota.

To Have and to Hold the Same, *Together with all the hereditaments and appurtenances thereunto belonging or in anywise appertaining, to the said part* y *of the second part,* his *heirs and assigns, Forever. And the said* John J. Jones, unmarried

part y *of the first part, for* himself and his *heirs, executors and administrators, do covenant with the said part* y *of the second part,* his *heirs and assigns, that* he is *well seized in fee of the lands and premises aforesaid, and has good right to sell and convey the same in manner and form aforesaid, and that the same are free from all incumbrances.*

And the above bargained and granted lands and premises, in the quiet and peaceable possession of the said part y *of the second part,* his *heirs and assigns, against all persons lawfully claiming or to claim the whole or any part thereof, subject to incumbrances, if any, hereinbefore mentioned, the said part* y *of the first part will Warrant and Defend.*

In Testimony Whereof, *The said part* y *of the first part has hereunto set* his *hand the day and year first above written.*

In Presence of

to his holdings. Each party may sell his or her interest at any time, and may dispose of that interest through a will. In the event of death without leaving a will, the interest of the deceased would pass to his heirs as provided by law. Where two or more persons hold real estate in this manner they will share in the

EXHIBIT D. QUITCLAIM DEED

This Indenture, *Made this* 1st *day of* May, 19 47, *between* John J. Jones, unmarried

of the County of St. Louis *and State of* Minnesota, *party of the first part, and* Frank J. Brown

of the County of St. Louis *and State of* Minnesota, *party of the second part,*

Witnesseth, *That the said party of the first part, in consideration of the sum of* One Dollar and other good and valuable consideration ~~DOLLARS~~, *to* him *in hand paid by the said party of the second part, the receipt whereof is hereby acknowledged, does hereby Grant, Bargain, Quitclaim, and Convey unto the said party of the second part,* his *heirs and assigns, Forever, all the tract or parcel of land lying and being in the County of* St. Louis *and State of Minnesota, described as follows, to-wit:*

The West Half of the Southwest Quarter of the Northeast Quarter ($W\frac{1}{2}$ of $SW\frac{1}{4}$ of $NE\frac{1}{4}$) of Section Eight (8), in Township Fifty-one (51) North of Range Thirteen (13) West of the 4th P.M., St. Louis County, Minnesota.

To Have and to Hold the Same, *Together with all the hereditaments and appurtenances thereunto belonging or in anywise appertaining, to the said party of the second part,* his *heirs and assigns, Forever.*

In Testimony Whereof, *The said party of the first part has hereunto set* his *hand the day and year first above written.*

In Presence of

State of Minnesota,
County of St. Louis } *ss.*

On this 1st *day of* May, 19 47, *before me,* a Notary Public *within and for said County, personally appeared* John J. Jones, unmarried

to me known to be the person described in, and who executed the foregoing instrument,
(See Note)
and acknowledged that he *executed the same as* his *free act and deed*
(See Note)

Notary Public St. Louis *County, Minn.*

My commission expires February 6th, 19 49.

NOTE: The blank lines marked "See Note" are for use when the instrument is executed by an attorney in fact.

income in proportion to the interest held by them. Where strangers own property together, this is the proper type of deed.

EXECUTION OF THE DEED

When a deed is prepared in accordance with the wish of the parties to the transaction, it must be signed by the grantor and acknowledged before some proper officer—usually a notary public—whose certificate of acknowledgement is added to the instrument. In some states two subscribing witnesses are required. The grantor, in order to make the deed effective, must deliver it to the grantee, since this act transfers title. The delivery of the deed may be made through agents of the parties. As a rule, if the grantor is married, his wife must join in signing the deed, otherwise she will retain her dower interest in the land. There are a few states that do not require the wife's signature, except in case of sale of the homestead. If he is unmarried, the deed should show the fact, as for example, John Jones, unmarried, or single, or bachelor. When documentary stamps are required, they should be placed on the deed before filing. The seller is usually required to pay the cost for these stamps. At this point, the deed should be checked carefully to make sure that the property is accurately described, and that the grantor's name is correctly spelled and is written as it appears in the abstract of title.

RECORDING THE DEED

It is wise to record the deed immediately after it is executed. It should be taken to the office of record in the County where the land is situated and the officer in charge should be requested to place it on record. A small fee is collected for performing this service. The filing and recording of the deed gives notice to the public of the grantee's interest in the land. If one fails to record the deed, and is not living on the land, someone else may take a deed on the same land, claiming that he had no evidence of your rights. In that event, if the second deed was filed and recorded before yours, the grantee under the second deed would have a superior title, assuming that he had no actual notice of your rights in the land.

CONTRACT FOR DEED

In some instances, where the purchaser of a farm is able to make only a small down payment on the purchase price, the seller gives a Contract for Deed instead of an outright deed to the land. The contract specifies the terms that must be met before a formal deed is executed and delivered by the seller conveying

Exhibit E. Warranty Deed to Joint Tenants

This Indenture, *Made this* 1st *day of* May, *19*47, *between* John J. Jones, unmarried

of the County of St. Louis *and State of* Minnesota, *party* *of the first part, and* Frank J. Brown and Mary A. Brown, his wife, *of the County of* St. Louis *and State of* Minnesota, *parties of the second part,*

Witnesseth, *That the said party of the first part, in consideration of the sum of* One Dollar and other good and valuable consideration ~~DOLLARS,~~ *to* him *in hand paid by the said parties of the second part, the receipt whereof is hereby acknowledged, do*es *hereby Grant, Bargain, Sell, and Convey unto the said parties of the second part as joint tenants and not as tenants in common, their assigns, the survivor of said parties, and the heirs and assigns of the survivor, Forever, all the tract or parcel of land lying and being in the County of* St. Louis *and State of Minnesota, described as follows, to-wit:*

The West Half of the Southwest Quarter of the Northeast Quarter ($W\frac{1}{2}$ of $SW\frac{1}{4}$ of $NE\frac{1}{4}$) of Section Eight (8), in Township Fifty-one (51) North of Range Thirteen (13) West of the 4th P.M., St. Louis County, Minnesota.

To Have and to Hold the Same, *Together with all the hereditaments and appurtenances thereunto belonging or in anywise appertaining, to the said parties of the second part, their assigns, the survivor of said parties, and the heirs and assigns of the survivor, Forever, the said parties of the second part taking as joint tenants and not as tenants in common.*

And the said John J. Jones

party of the first part, for himself and his *heirs, executors and administrators do*es *covenant with the said parties of the second part, their assigns, the survivor of said parties, and the heirs and assigns of the survivor, that* he is *well seized in fee of the lands and premises aforesaid and ha*s *good right to sell and convey the same in manner and form aforesaid, and that the same are free from all incumbrances,*

And the above bargained and granted lands and premises, in the quiet and peaceable possession of the said parties of the second part, their assigns, the survivor of said parties, and the heirs and assigns of the survivor, against all persons lawfully claiming or to claim the whole or any part thereof, subject to incumbrances, if any, hereinbefore mentioned, the said party of the first part will Warrant and Defend.

In Testimony Whereof, *The said party of the first part ha*s *hereunto set* his *hand the day and year first above written.*

In Presence of

full title to the property. Usually 25 per cent to 40 per cent of the purchase price must be paid before title is transferred, though the amount is a matter of bargaining between the parties concerned. Exhibit F illustrates the form of a Contract for Deed.

Under this type of ownership, failure to comply with the terms

EXHIBIT F. CONTRACT FOR DEED

This Agreement, *Made and entered into this* 1st *day of* May 1947, *by and between* John J. Jones, unmarried

party of the first part, and Frank J. Brown

, party of the second part;

Witnesseth, *That the said party of the first part in consideration of the covenants and agreements of said party of the second part, hereinafter contained, hereby sells and agrees to convey unto said party of the second part* his heirs, *and assigns, by a* warranty *Deed, accompanied by an abstract evidencing good title in party of the first part at the date hereof, or by an owner's duplicate certificate of title, upon the prompt and full performance by said party of the second part, of* his *part of this agreement, the tract of land, lying and being in the County of* St. Louis *and State of Minnesota, described as follows, to-wit:*

The West Half of the Southwest Quarter of the Northeast Quarter (W½ of SW¼ of NE¼) of Section Eight (8), in Township Fifty-one (51) North of Range Thirteen (13) West of the 4th P.M., St. Louis County, Minnesota.

And said party of the second part, in consideration of the premises, hereby agrees to pay said party of the first part, at 705 Providence Building, Duluth, Minnesota *as and for the purchase price of said premises, the sum of* Two Thousand and no/100 - *Dollars, in manner and at times following, to-wit:*

Five Hundred Dollars ($500.00) cash in hand paid, receipt of which is hereby acknowledged; One Thousand Dollars ($1000.00) by assumption hereby of that certain mortgage recorded in the office of the Register of Deeds in and for said County and State in Book 106 of Mortgages on Page 2; and the balance of Five Hundred Dollars ($500.00) in five installments of One Hundred Dollars ($100.00) each payable on the first day of May of the years 1943, 1944, 1945, 1946 and 1947, together with interest at the rate of five per cent per annum to be computed on the unpaid balance of principal.

Said party of the second part further covenants and agrees as follows: to pay, before penalty attaches thereto, all taxes due and payable in the year 1948, and in subsequent years, and all special assessments heretofore or hereafter levied, ;

also that any buildings and improvements now on said land, or which shall hereafter be erected, placed, or made thereon, shall not be removed therefrom, but shall be and remain the property of the party of the first part until this contract shall be fully performed by the party of the second part; and at his own expense, to keep the buildings on said premises at all times insured in some reliable insurance company or companies, to be approved by the party of the first part, against loss by fire for at least the sum of One Thousand Dollars ($1000.00) Dollars and against loss by windstorm for at least the sum of Seven Hundred and Fifty and no/100 - Dollars, payable to said party of the first part, his heirs or assigns, and, in case of loss, should there be any surplus over and above the amount then owing said party of the first part, his heirs, or assigns, the balance shall be paid over to the said party of the second part as his interest shall appear, and to deposit with the party of the first part policies of said insurance. But should the second party fail to pay any item to be paid by said party under the terms hereof, same may be paid by first party and shall be forthwith payable, with interest thereon, as an additional amount due first party under this contract.

But should default be made in the payment of principal or interest due hereunder, or of any part thereof, to be by second party paid, or should he fail to pay the taxes or assessments upon said land, premiums upon said

of the contract will permit the seller to foreclose the buyer's interest by canceling the contract. In most states the manner of

Exhibit F. Contract for Deed *(Continued)*

insurance, or to perform any or either of the covenants, agreements, terms or conditions herein contained, to be by said second part y kept or performed, the said part y of the first part may, at his option, by written notice declare this contract cancelled and terminated, and all rights, title and interest acquired thereunder by said second part y, shall thereupon cease and terminate, and all improvements made upon the premises, and all payments made hereunder shall belong to said part y of the first part as liquidated damages for breach of this contract by said second part y, said notice to be in accordance with the statute in such case made and provided.

Neither the extension of the time of payment of any sum or sums of money to be paid hereunder, nor any waiver by the part y of the first part of his rights to declare this contract forfeited by reason of any breach thereof, shall in any manner affect the right of said part y to cancel this contract because of defaults subsequently maturing, and no extension of time shall be valid unless evidenced by duly signed instrument. Further, after service of notice and failure to remove, within the period allowed by law, the default therein specified, said part y of the second part hereby specifically agrees, upon demand of said part y of the first part, quietly and peaceably to surrender to him possession of said premises, and every part thereof, it being understood that until such default, said part y of the second part is to have possession of said premises.

It is Mutually Agreed, *By and between the parties hereto, that the time of payment shall be an essential part of this contract; and that all the covenants and agreements herein contained shall run with the land and bind the heirs, executors, administrators, successors and assigns of the respective parties hereto.*

In Testimony Whereof, *The parties hereto have hereunto set their hands the day and year first above written.*

In Presence of

______________________ ______________________

______________________ ______________________

____

____

State of Minnesota,
County of St. Louis } *ss.*

On this 1st *day of* May, *19* 47, *before me, a* Notary Public *within and for said County, personally appeared* John J. Jones, unmarried and Frank J. Brown

to me known to be the person s *described in, and who executed the foregoing instrument, and acknowledged that* they *executed the same as* their *free act and deed.*

____

Notary Public St. Louis *County, Minn.*

My commission expires February 6th, *19* 49

canceling land contracts is prescribed by statute. Proceedings of this type require strict compliance with such laws. It is well for one accepting a contract for deed to read the laws of the state in which the contract is offered, so as to be fully familiar with its application. Usually, under a cancellation proceeding in case of failure to meet the terms of the contract, the seller can gain possession of the land within a comparatively short time. For this reason, purchasing real estate under contract requires that the buyer meet the stipulated payments promptly and that he perform all other provisions of the contract. Failure to do so

will give the seller the right to cancel the contract. The purchaser under a Contract for Deed is usually required to pay the taxes and to keep the buildings on the premises properly insured.

MORTGAGES

A mortgage is the written conveyance of the title to property as security for the payment of a debt or other obligation. The person making the mortgage, such as an owner of the land borrowing money, is the mortgagor; the party loaning the money is called the mortgagee. More than one mortgage may be made on a given parcel of land, in which case they may be referred to as first and second mortgages. Promissory notes are usually executed in addition to the mortgage and, in good practice, reference is made to the note or notes to the effect that they are secured by a certain mortgage.

The mortgage, in addition to other provisions, contains covenants similar to those appearing in a Warranty Deed. The conveying provisions, however, become null and void when all the terms of the mortgage are fulfilled.

As shown above in the Contract for Deed, a mortgage may already be an encumbrance on the land when bought. In that case, the purchaser in purchasing the farm may receive a deed and assume the contract obligation of the mortgage. If the mortgagor fails to meet the payments or other conditions of the mortgage, the mortgagee may foreclose the mortgage as provided by the statutes of the state where the land is situated. Usually, under a mortgage foreclosure the mortgagor has a period of time, usually one year, within which he may redeem the property. In some cases under the moratorium in force in some states this period may be prolonged.

POINTS TO BE REMEMBERED IN BUYING A FARM

1. Make a complete inspection of the farm.
2. Be sure that the boundaries are properly defined, so that there will be no party line dispute.
3. Secure the services of a reputable lawyer.
4. Assure yourself that the seller has good title.
5. Draw the Earnest-Money Contract with care.
6. Read and examine the deed or contract for deed carefully and see that it is properly executed and is of the correct type.
7. If the seller is married, have his wife join with him in the deed.
8. Check for mechanics' liens and also ascertain the interest of parties in possession.
9. Make certain that all documents are recorded immediately in the proper office.

10. Do not rely on verbal representation, when such representations can be reduced to writing and signed by the parties.

FARM LEASE CONTRACTS

Figures in 1945 showed that 32 per cent of the farms in the United States are operated by renters. In each case, these transactions involve a lease either written, verbal, or implied. Frequently the arrangements entered into between the owner and the renter are of a loose and indefinite character, resulting in misunderstandings throughout the term of the lease. This lack of more careful attention contributes largely to unsatisfactory relationships between landlord and tenant. While laws covering this subject may clarify certain practices and procedures, the real improvement must come through the owner's and the renter's "talking things over." The best time to carry on these conversations is *before* entering into the leasing agreement. The points agreed upon should then be written into a valid lease. A written lease properly drawn, with provisions thoroughly understood by the parties involved, will solve most of the problems that are likely to develop. In many cases, however, a written lease is just a matter of form. For example, the landlord obtains a form and has it filled in and signed without studying its contents or considering its suitability. This written document will be interpreted by the courts, if trouble arises, on the basis of the written provisions. In other cases, the owner may be familiar with the contents, but the renter may be wholly unaware of what the contract contains. Such cases are likely to lead to poor relationships between the parties to the lease.

Because so many leases are poorly drawn and the content of the lease so little understood, an analysis of one of the common lease forms is presented in the following section. Comments are made on each provision of the lease for the purpose of calling attention to the points over which controversies are likely to arise. The discussion will serve the further purpose of familiarizing the student with the provisions commonly printed in lease forms.

A SAMPLE FARM LEASE

THIS AGREEMENT, *Made this* *day of* *19*
by and between
party of the first part, Lessor, and
of the Township of
and State of *County of*
party of the second part, Lessee,

WITNESSETH, That the said party of the first part, in consideration of the rents and covenants hereinafter mentioned, does hereby Remise, Lease

and Let unto the said party of the second part, and the said party of the second part does hereby hire and take from the said party of the first part, the following described premises situated in the County of and State of viz: in Section Number Township Number Range Number containing acres be the same more or less, of which described premises the second party hereby agrees to plow and put in crops not less than acres each year during the continuance of this Lease.

TO HAVE AND TO HOLD, *The above rented premises unto the said second party, heirs and assigns, subject to the conditions and limitations hereinafter mentioned, for and during the full terms of years from and after the day of 19 , the term of this Lease ending the days of 19*

And the said second party agrees to and with the said first party to pay as rent for the above mentioned premises, for and during the full term of this Lease, the sum of Dollars, payable at in installments with interest at the rate of per cent on each installment after due, to-wit:

$	*on or before*	$	*on or before*
$	*on or before*	$	*on or before*
$	*on or before*	$	*on or before*
$	*on or before*	$	*on or before*
$	*on or before*	$	*on or before*

And it is Further Agreed, By and between the parties as follows: That should the said second party fail to make the above mentioned payments as herein specified, or to pay any of the rent aforesaid when due, or fail to fulfill any of the covenants herein contained, then and in that case said first party may re-enter and take possession of the above rented premises, and hold and enjoy the same without such re-entering working a forfeiture of the rents to be paid by the said second party for the full term of this lease.

That if the said first party sells said premises during the life of this lease and before the crop is in the ground, and desires to give possession to the purchaser, that the second party will forthwith surrender possession of said leased premises upon the payment to of $ per acre for each acre of said premises newly plowed by said second party at the time said possession is demanded if sold after the crop is in, then said second party shall have the right to remove such crop when ready to be harvested. That if said first party sells said premises during the term of this lease, the purchaser may at any time enter upon the leased premises for the purpose of plowing, breaking more land, summer-fallowing, cultivating or otherwise improving any part of said premises not in actual cultivation by said second party, and without such entry working any forfeiture of the rents herein agreed to be paid.

That if said second party remains in possession of said premises after the expiration of the term for which they are hereby leased, such possession shall not be construed to be a renewal of this lease, but to be a tenancy at the will of said first party, which may be terminated upon ten days' notice, given by the said first party in writing, either delivered to second party or sent to in a sealed envelope, duly stamped and directed to at which is hereby declared by to be usual Post-office address.

And the said second party also covenants and agrees to and with the said first party, not to assign this lease or underlet the above rented premises or any part thereof, without first obtaining the written consent of the said first party.

And that will, at the expiration of the time as herein recited, quietly yield and surrender the aforesaid premises to the said first party, his heirs or assigns, in as good condition and repair as when taken, reasonable

wear and tear and damage by the elements alone excepted. Said second party also covenants and agrees to cultivate the hereby leased premises in a careful and husband-like manner, and to maintain and keep up the fences so as to protect all crops from injury and waste, and to protect the fruit and shade trees thereon, and to cut no green trees and to commit no waste or damage on said real estate and to suffer none to be done; and to keep up and maintain in good repair all buildings, stables, cribs, fences and improvements on said farm; and further agrees not to remove any straw or manure from said farm, but to spread upon said premises all manure made thereon.

The party of the second part is also to destroy all Russian thistles and other noxious weeds growing on said land, declared by statute to be common nuisances, within the times prescribed by law, and shall keep all roadways and other parts of the land, not in crop, mowed and free from growing weeds. And the first party or his agent shall have the right to enter upon said premises at any time, without injury to the standing crops, for the purpose of making any improvements, or to prepare for the succeeding crop.

And the said first party covenants that the said second party, on paying the rent and performing the covenants aforesaid, shall peaceably and quietly have, hold and enjoy the said remised premises for the term aforesaid.

To secure the payment of the rents herein specified and the faithful performance and strict fulfillment of all the covenants of said second party in this lease contained, said second party does hereby expressly mortgage unto said first party all crops growing or grown on said premises during the term of this lease, and does hereby expressly authorize and fully empower said first party in the case of any default on the part of said second party in paying said rent or in performing any of the covenants in this lease, to seize and take possession of said mortgaged property at once, and sell the same at public auction, with notice as provided by law and out of the proceeds of said sale, to pay and discharge all rents, damages, and expenses which may at the time be due and incurred, and pay over to said second party the surplus money arising from such sale.

IN TESTIMONY WHEREOF, *Both parties have hereunto set their hands and seals the day and year hereinbefore written, and I, the undersigned mortgagor hereby acknowledge that at the time of the making and delivery of the foregoing Chattel Mortgage the mortgagee delivered to me a full, true and complete copy thereof.*

Signed, Sealed, and Delivered
in Presence of

....*Seal*
....*Seal*
....*Seal*
....*Seal*

STATE OF ....
COUNTY OF.............................. } *ss.*

On this..............................day of..............................A. D. 19 , before me a..within and for said County, personally appeared ....
....
....
to me known to be the person described in and who executed the foregoing instrument, and acknowledged that he executed the same as......................free act and deed.

....
....

ANALYSIS OF THE FARM LEASE [1]

Forms of farm lease contracts are numerous and vary greatly. They are based on the laws in force in the states where used. Because of the variation in laws from state to state and the numerous forms of lease contracts in use, it is thought best to present only one lease form with a comprehensive discussion of the provisions as stated. Instructors are advised to make collections of the forms of lease contracts in use in the school district served and to make a comparative analysis of the provisions of each.

A. "THIS AGREEMENT, made this 15th day of February, 1942, by and between John S. Brown, of St. Paul, Minnesota, party of the first part, Lessor, and Frank Jones, of Fulda, Minnesota, party of the second part, Lessee."

The relationship of landlord and tenant is created by contract, either expressed or implied, by the terms of which one person, designated the tenant, enters into possession of the land under another person, known as the landlord. The word landlord, under ordinary usage means the same as "lessor," and the word tenant, the same as "lessee." It is well to remember the meanings of these terms.

A lease has been defined as a contract for the possession and profit of land on the one side, and a recompense of rent, or other income, on the other. As in the case of all contracts, there must be two or more parties competent in the eyes of law to transact business. The words, "party of the first part," and "party of the second part" are used for the purpose of making certain the identification of the parties relative to their respective undertakings and to eliminate the necessity of repeating their names in full each time. Much humor is attached to these phrases by the public, but, nevertheless, they serve a real purpose. The important phase of this section of a lease contract is to make sure that the persons making it have the right and the power to make the lease and to be bound by all its provisions.

B. "WITNESSETH, That the said party of the first part, in consideration of the rents and covenants hereinafter mentioned, does hereby Remise, Lease, and Let unto the said party of the second part, and the said party of

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[1] The form of lease presented is only one of many forms found in common use. It is discussed in sections to acquaint the student with the many complex problems covered in a lease. Leases for cash rent, cash and crop-share leases, crop and livestock-share leases are used in many varying forms. While each form is carefully and skillfully drawn, it must be studied with care before adapting it to specific use in leasing a farm.

the second part does hereby hire and take from the said party of the first part, the following described premises situated in the County of............................ and State of..viz.: "in Section Number............................... Township Number..Range Number.................................. containing..acres be the same more or less, of which described premises."

The word "remise" means to convey or to grant; the word "lease," to grant possession of lands for a period, and the word "let," to permit the use of the land.

A lease is a conveyance, although it conveys a lesser interest than that held by the owner or landlord. No particular form of words is necessary to constitute an instrument a lease and to create the relationship of landlord and tenant. At Common Law, the unwritten law, an oral lease is valid. In most jurisdictions, there are, however, statutes relating to the execution of conveyances of interest in land, or statutes of fraud which require a writing signed by the lessor where the lease is of a certain duration. For example, in Minnesota, any lease running for a period of more than one year from the time of its making, must be in writing. This requirement may differ in the various states. The safe and best rule to follow is to have a written lease without regard to the length of the same. In this section of the lease, the description of the property is shown and this description must be complete in all respects. The premises *must* be described with certainty.

C. "The second party hereby agrees to plow and put in crops not less than..............acres each year during the continuance of this lease."

In all cases the courts will give a liberal interpretation of this provision of a lease, since weather and the elements sometimes may require modification of the farming operations and hence strict compliance would be impossible. In many lease forms, however, the landlord exercises a more complete control than is shown in the above provision, in which case the tenant is obligated to carry out his part of the agreement. Remember, the tenant has possession of valuable property and, without some restrictions on its use, the tenant could, unless stated, make any use of the land short of waste. For that reason a careful landlord will set out in a lease the definite specifications relative to the use to be made of the land.

D. "TO HAVE and TO HOLD, The above rented premises unto the said second party,..........................heirs and assigns, subject to the conditions and

limitations hereinafter mentioned, for and during the full term of.................... years from and after the...........................day of..........................., 19........, the term of this lease ending the..........................day of..............................., 19........"

This provision gives the tenant the right to quiet and peaceful enjoyment and use of the land for a definite period of time. At the end of this period, the tenant is obligated, under his agreement, to return the land to the owner. In a provision that follows, this point will be discussed more fully, as may be noted from the language, "subject to the conditions and limitations hereinafter mentioned."

It should be observed that, in the absence of a provision so permitting, a landlord may not enter the premises during the term of a lease. Although there is authority to the effect that a landlord has the right during a tenancy to enter to make such repairs as are necessary to prevent waste; yet, unless the landlord reserves the right, he has, during the term of the lease, no right to enter upon the demised premises to make alterations and improvements, to investigate the need of repairs, or to make even necessary repairs. His presence on the property would be that of a trespasser, and subject to ejectment from the premises. It may be seen from this observation that leasing a farm is a serious business from the viewpoint of the landlord as well as from that of the tenant.

Under some lease forms a provision is added to the effect that this lease shall continue for a like term unless written notice is given to the landlord thirty days prior to date of termination. Under provision of this type, a tenant or a landlord will be bound to continue, renew, or extend the lease for a like period unless the proper notice is given. The notice should be in writing and sent by registered mail with a return receipt requested, so that no question as to compliance can be raised. The notice should be mailed early, so as to avoid technicalities regarding the 30-day requirement. This form of provision can be a double-edged sword. It may work as an advantage or a disadvantage to either party. For example, if, as a tenant, you fail to read the provision and rent another farm without giving notice, you may find yourself bound to pay rent on two farms. Some courts hold that the word "extends" means the present lease is in effect for another term, whereas the word "renew" requires the preparation and execution of a new lease under the same terms.

E. "And the said second party agrees to and with the said first party

to pay as rent for the above mentioned premises, for and during the full term of this Lease, the sum of............................Dollars, payable to........................ in............installments with interest at the rate of............per cent on each installment after due, to-wit:

$..................on or before.................. $..................on or before ....
$..................on or before.................. $..................on or before..................
$..................on or before.................. $..................on or before..................
$..................on or before.................. $..................on or before..................
$..................on or before.................. $..................on or before.................."

In this section of the lease, the amount of rent charged and the manner of payment should be set out in full. The landlord has a right to expect that the payment will be made promptly and in accordance with the terms of the agreement. In order to protect against a default in payment, the landlord and tenant should arrange that the payments shall be placed at times when the tenant will be in position to meet them from the profits of the farming operation. If the land is operated as a dairy farm, monthly installments may be the better plan of payment. If the tenant derives his profit exclusively from corn as a cash crop, then payment late in the fall, in one installment, may be the most desirable plan. The point emphasized here is to arrange payment at a suitable time when the tenant is likely to be in position to carry out the agreement.

F. "And it is further agreed, By and between the parties as follows: That should the said second party fail to make the above mentioned payments as herein specified, or to pay any of the rent aforesaid when due, or fail to fulfill any of the covenants herein contained, then and in that case said first party may re-enter and take possession of the above premises, and hold and enjoy the same without such re-entering working a forfeiture of the rents to be paid by the second party for the full term of the lease."

The rights of the landlord upon default of the tenant are expressed in this provision. Failure to make payment as agreed will permit the landlord to take possession and at the same time hold the tenant liable for the balance of the rent. While the decisions of the court may vary in giving full force to the intent of this provision, yet a safe rule is to be prepared to make all payments promptly, or "talk it over" with the landlord.

G. "That, if the said first party sells said premises during the life of this lease and before the crop is in the ground, and desires to give possession to the purchaser, the second party will forthwith surrender possession of said leased premises upon the payment to............................of $............................ per acre for each acre of said premises newly plowed by said second party at the time said possession is demanded. If sold after the crop is in, then said second party shall have the right to remove such crop when ready to

be harvested. That if said first party sells said premises during the term of this lease, the purchaser may at any time enter upon the leased premises for the purpose of plowing, breaking more land, summer fallowing, cultivating or otherwise improving any part of said premises not in actual cultivation by said second party, and without such entry working any forfeiture of the rents herein agreed to be paid."

The above provision, known as the sales clause, appears in many lease forms. This in effect renders the term of lease uncertain. For example, a five-year lease containing a like provision could be terminated during any year of the term by a sale of the property and the proper notice. This type of provision is one of the main problems under our system of land tenure. A tenant whose term is uncertain is little inclined to make improvement in buildings or land operations since he does not know whether or not he can benefit by such improvement. This practice puts a damper on long-time planning and in the end both the landlord and the tenant suffer. Public opinion favors a modification of this practice by requiring the landlord to pay the tenant for any unused portion of improvements made by him upon surrendering possession to the landlord for any reason. An example of this provision might be where the tenant applies lime on alfalfa. The beneficial result of this application may well carry over beyond the term of the lease. Or it may be a case of seeding alfalfa, applying fertilizers, or summer fallowing of the land. Students of this problem realize that any action which would restrict or interfere with the sale of land would hinder, to some degree, the possibility of converting absentee landlord-owned farms to owner-operated farms; and that any provision permitting the sale without full regard for the interests of the tenant may bring about exploitation of the soil, without long-range conservation. It is not too much to hope that a compromise between these extremes may be worked out through proper compensation to the tenant for his disturbance from possession. This should include cost of moving as well as cost of the improvement made. The compensation or reimbursement can be determined by the parties or through an arbitration board selected in a manner provided by agreement.[1]

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[1] All disputes and differences arising out of this lease shall be settled and finally determined in the City of.............................., by arbitration in the following manner. Each party to this agreement shall appoint an arbitrator. If the two arbitrators so appointed can not agree within one month after their appointment, they will select a third arbitrator. The decision of the three arbitrators, or any two of them, shall be final and binding upon the parties herein, who

This provision is sometimes used in settling differences under a stock-share lease, where adjustments in livestock increase and inventories of feed supplies are necessary upon termination of the lease.

H. "That, if said second party remains in possession of said premises after the expiration of the term for which they are hereby leased, such possession shall not be construed to be a renewal of this lease, but to be a tenancy at the will of the said first party, which may be terminated upon ten days' notice, given by the said first party in writing, either delivered to second party or sent to..in a sealed envelope, duly stamped and directed to..at ....which is hereby declared by.......................... to be..........................usual post office address."

Under the above provision, the lease definitely expires on a certain date. If a tenant should hold over beyond the term, the landlord has the advantage of considering the occupant as a tenant for a year, or he may treat him as a tenant at will. Under the latter arrangement, the tenancy is uncertain insofar as the renter is concerned; but, if the landlord permits the tenant to put in a crop without attempting to remove him, most courts would hold that a lease was implied from the acts of the parties. Implied leases of this type are unsatisfactory from the viewpoint of both parties. No person should bargain for a lawsuit when "talking things over" may produce favorable results and save worry, time, and expense.

I. "And the said second party also covenants and agrees to and with the said first party, not to assign this lease or underlet the above rented premises or any part thereof, without first obtaining the written consent of the said first party."

Ordinarily a tenant may assign or sublet his lease to another unless the landlord limits that right. For that reason most leases contain a restriction somewhat as stated above. This provision requires the written consent of the landlord and, therefore, before a tenant could assign or sublet under the lease, he would be required to discuss the matter with the landlord and secure his written consent. Otherwise, failure to do so would be considered a breach of contract. This rule also applies to subletting a portion of the farm.

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shall conform to and abide by said decision. If either party fails to appoint his arbitrator within fourteen days after notice in writing requires him to do so, the arbitrator appointed by the other party shall act for both; his decision in writing shall be final and binding upon both parties, as if he had been appointed by counsel, and both parties thereto shall conform to and comply therewith."

J. "and that......................................will, at the expiration of the time as herein recited, quietly yield and surrender the aforesaid premises to the said first party, his heirs or assigns, in as good condition and repair as when taken, reasonable wear and tear and damage by the elements alone excepted. Said second party also covenants and agrees to cultivte the hereby leased premises in a careful and husbandlike manner, and to maintain and keep up the fences so as to protect all crops from injury and waste, and to protect the fruit and shade trees thereon, and to cut no green trees and to commit no waste or damage on said real estate and to suffer none to be done; and to keep up and maintain in good repair all buildings, stables, cribs, fences and improvements on said farm; and further agrees not to remove any straw or manure from said farm, but to spread upon said premises all manure made thereon."

Under this section of the lease, the tenant agrees to return the premises in as good a condition as when he received them, reasonable wear and tear excepted. It will be noted that the landlord does not obligate himself to make repairs. The landlord is under no obligation to make repairs or improvements unless he has expressly agreed to do so, and there is no implied covenant in a lease that the premises are or will continue to be fit for the purpose for which they are let. In order to exclude any claim that the landlord has made an agreement to repair, some leases state specifically that the landlord is under no obligation to make any repairs or improvement and that the tenant takes the premises as they are.

Also, a landlord, unless he has agreed to do so, is not ordinarily bound to furnish water to his tenant.

While the tenant is prevented from cutting green trees under this provision, it would seem clear that the rule generally followed in this country is that the tenant has the right to take from the demised premises such an amount of wood or lumber as is required or necessary for fuel, the repair of buildings, the repair of implements of husbandry, the repair of fences, and other agricultural needs.

The rule regarding disposition of manure created on the land indicates that, where the feed is grown on the premises, such manure must be returned to the land; but, where a tenant purchases hay, straw and feed, or where he produces such feed on another tract of land, that such portion may be removed without violation of the provision, unless a specific provision prevents such disposition.

K. "The party of the second part is also to destroy all Russian thistles and other noxious weeds growing on said land, declared by statute to be

common nuisances, within the times prescribed by law, and shall keep all roadways and other parts of the land, not in crop, mowed and free from growing weeds. And the first party or his agent shall have the right to enter upon said premises at any time, without injury to the standing crops, for the purpose of making any improvements or to prepare for the succeeding crop."

The provision relative to the treatment of weeds is common and, in any event, most states have laws governing the control of noxious weeds. The tenant is obligated to comply with this provision as well as with the State Laws.

L. "*And the said first party covenants that the said second party, on paying the rent and performing the covenants aforesaid, shall peaceably and quietly have, hold, and enjoy the said remised premises for the term aforesaid.*"

After performing all these conditions, the tenant has the exclusive right of quiet and peaceable enjoyment of the entire premises.

M. "*To secure the payment of the rents herein specified and the faithful performance and strict fulfillment of all the covenants of said second party in this lease contained, said second party does hereby expressly mortgage unto said first party all crops growing or grown on said premises during the term of this lease, and does hereby expressly authorize and fully empower said first party, in the case of any default on the part of said second party in paying said rent or in performing any of the covenants in this lease, to seize and take possession of said mortgaged property at once, and sell the same at public auction, with notice as provided by law and out of the proceeds of said sale to pay and discharge all rents, damages, and expenses which may at the time be due and incurred, and pay over to said second party the surplus money arising from such sale.*"

The provision known as a Chattel Mortgage clause conveys the title and right to possession of the crops grown on the premises as security for the payment of the rent stipulated in the lease. Some provisions go so far as to include all the personal property owned by the tenant. No particular words or phrases are necessary to create a mortgage as long as the intent of the parties is present. Most states, however, require a lease with a chattel mortgage clause to be executed before a notary and properly witnessed in order that it may be filed in the proper recording office. The filing of the instrument gives third parties notice of the existence of the mortgage.

Usually a lease form will provide adequate space to insert special provisions. The arbitration clause heretofore shown may be treated as a special provision. Also, if a tenant, while in possession, is to, or does, install any fixtures which may later be

claimed by the landlord as part of the real estate, then a provision may be made permitting the removal of such fixtures at the termination of the lease. Here would be a proper place to describe and set out any repairs or improvements that a landlord may agree to make. In view of the rule that a landlord is not obligated to make repairs unless he agrees to do so, a statement of the repairs to be made should be described in detail.

N. "IN TESTIMONY WHEREOF, Both parties have hereunto set their hands and seals the day and year hereinbefore written, and I, the undersigned mortgagor hereby acknowledge that at the time of the making and delivery of the foregoing Chattel Mortgage the mortgagee delivered to me a full, true and complete copy thereof.

Signed, Sealed, and Delivered
in Presence of

....Seal
....Seal
....................................Seal
....................................Seal

COUNTY OF.................................... }
STATE OF.................................... } ss.

On this......................day of..................................A. D. 19........,
before me a....................................within and for said County,
personally appeared ....
....
to me known to be the person....described in and who executed the foregoing instrument, and acknowledged that he executed the same as............................free act and deed.

....

A signed lease is binding between the parties even though such lease is not acknowledged before a Notary. In some states, however, a lease for a period of more than three years must be signed before a Notary and properly witnessed. Also, in those cases where the lease contains a Chattel Mortgage clause, the lease must be acknowledged as stated above.

Points To Observe in Renting a Farm

1. Select a good farm.
2. Discuss fully all points relative to the rental arrangement.
3. Have a written lease drawn up expressing the intention of both parties.
4. Read each provision carefully.
5. Check for Sales Clause and Chattel Mortgage Clause.

6. Have lease properly executed by the parties, making certain that the person with whom you are dealing has the power to deliver a valid lease.

NEGOTIABLE INSTRUMENTS

The farmer, to be successful, should have knowledge of business as well as of the technique of farming. The business phase of farming requires an intimate knowledge of the function of promissory notes, checks, chattel mortgages, conditional sales contracts, and bookkeeping. In this limited space it will be impossible to cover these topics fully. Emphasis will be placed on the subject of negotiable instruments, since these instruments are used to a large extent by farmers.

NOTES AND CHECKS. Promissory notes and bank checks are negotiable instruments. The former are promises to pay; the latter, orders to pay. The party signing the note and promising to pay is called the "maker," the party signing the check is called the "drawer." The party to whom these instruments are addressed is called "payee" or "drawee," respectively.

There are two important characteristics in this type of paper, which is in effect a contract. First, every negotiable instrument is presumed to have been given for a valuable consideration; secondly, such paper, like money, may be transferred from person to person. Let us examine a copy of a Promissory Note and analyze the qualities that make it negotiable.

$500.00 St. Paul, Minnesota, November 1, 1949

Six months after date I promise to pay to the order of John Jones - - - - - - - - - - - - - -
Five hundred and no/100 Dollars.
Payable at St. Paul, Minnesota.

Value received with interest at the rate of 6% per annum until paid.

William H. Peters

Figure 36. A Negotiable Promissory Note.

Either a note or a check, to be negotiable must conform to the following requirements:

1. It must be in writing and signed by the maker, or drawer.
2. Must contain an unconditional promise or order to pay a certain sum in money.

3. Must be payable on demand or at a fixed or determinable future time.
4. Must be payable to either order or to bearer.
5. Where the instrument is addressed to a drawee, he must be named or otherwise indicated therein with reasonable certainty.

A legal instrument, to be negotiable, must contain all the essential points outlined above. If a note meets all these requirements, it may be transferred from person to person by endorsement. For example, Peters signs the above note. If Jones sells the note to Brown, he must first endorse it. If the note is transferred before it is due, Brown may collect the note, even though Peters could set up a defense against payment to Jones. That is one of the qualities of a negotiable instrument that is not common to an ordinary contract. The next illustration will bring out this point more clearly.

$100.00 St. Paul, Minnesota, December 1, 1949
Six months after date I promise to pay - - - - - - -
to John Jones - - - - - - - - - - - - - - - -
One hundred and no/100 - - - - - - - - - Dollars
at St. Paul, Minnesota.
Value received.
William H. Peters

Figure 37. A Nonnegotiable Promissory Note.

This note does not meet the requirement under item 4 that it—"must be payable to order or to bearer." The note states, "six months after date I promise to pay to John Jones," not "to the order of John Jones." This note, therefore, is nonnegotiable. It does not mean that the note is not good. It does mean that the original party can transfer no greater right than he has in the instrument. If Jones, the original holder, could not lawfully collect from Peters because of some defense against payment, then anyone to whom he assigned it would have no greater right to collect. Knowledge of this type of note can be helpful in some transactions. For example, if one purchased a horse on representations of the seller, and could not determine whether the representations are true, because, if misrepresented, he could return the horse and refuse payment. If one entered into a transaction where the seller has agreed not to negotiate the note, the agreement can be doubly assured by striking out the word

"order." There would be no injustice to the seller, since he has given assurance he will not negotiate the note.

SIGNING NOTES AS AN ACCOMMODATION. It is not uncommon for a person seeking a loan to ask another to sign a note with him as additional security to the one advancing the funds. In other words, the bank or maker advancing the funds is not fully satisfied with the promise of the borrower and wishes to gain additional security by having a second party sign the note as an accommodation. The borrower, desiring assistance in making the loan, is likely to say "I will pay this obligation when it is due and you will not be held liable." The question may well enter your mind—What are my responsibilities if I sign this note? The answer is that an accommodation party is one who has signed the instrument as a maker without receiving value therefor, and for the purpose of lending the value of his name to some other person. Such a person is liable to a holder of the instrument for full value notwithstanding the fact that such holder at the time of taking the instrument knew him to be signing only as accommodation to the borrower. When a friend asks you to sign a note with him, it would be well to ask yourself whether, "you will be satisfied to make good the note if the other person does not pay the note when due?" If your answer is yes, then sign. It is poor policy, however, to sign notes with others.

CHECKING ACCOUNTS. A checking account with a bank is a convenience in paying bills or other obligations. The canceled check is evidence of payment and makes an excellent record for business purposes. As pointed out before, checks are negotiable instruments. They are orders drawn on a bank where you have an account, requesting payment. A properly drawn check is illustrated in Figure 38.

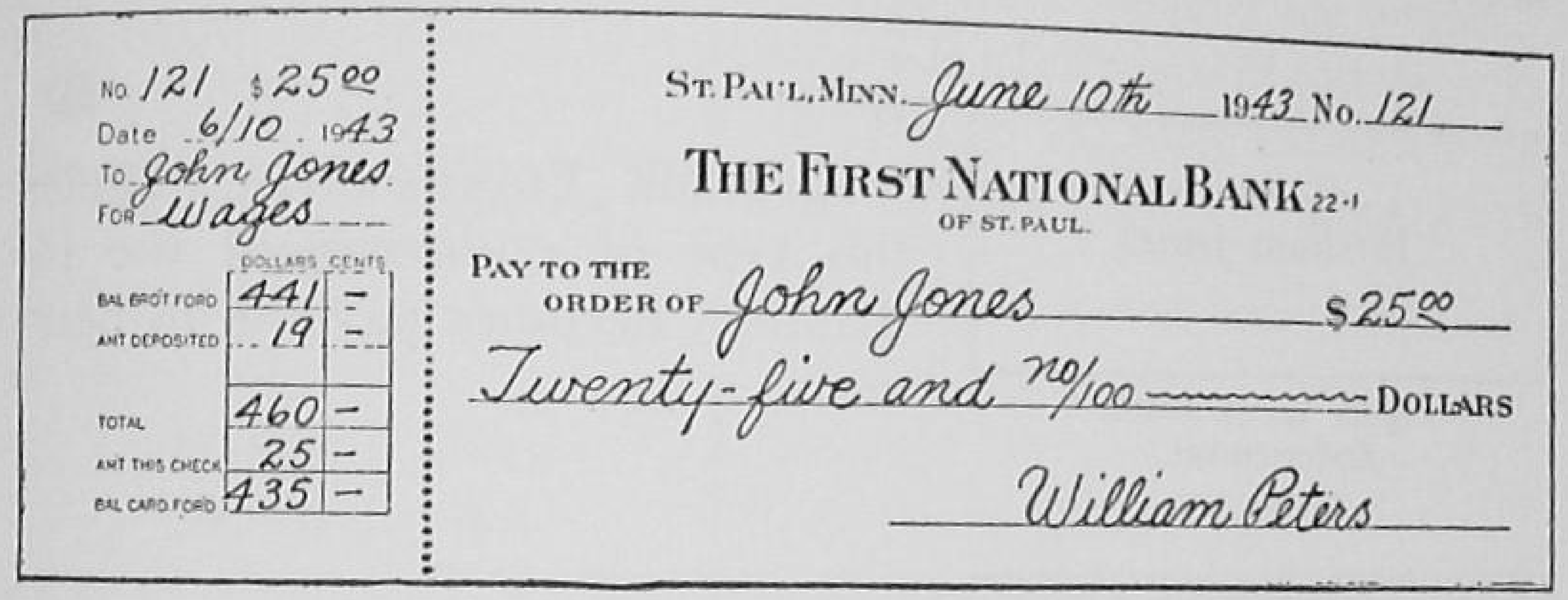
Remember that:

1. Checks should be written legibly with ink or indelible pencil.
2. The date should be stated (although an undated check is not so defective as to render it nonnegotiable).
3. The name of the payee should be filled in.
4. The amount of the check shown in figures should be close to the dollar sign, so as to eliminate possibility of alteration.
5. The amount should be written out in words by starting close to the left side margin and any blank spaces filled by drawing a line to the word "Dollars."
6. The check should be signed in the manner appearing on your signature card at the bank.

7. The stub should be completed in all respects. As a matter of good practice, the stub should be filled in completely before writing the check.

You should:

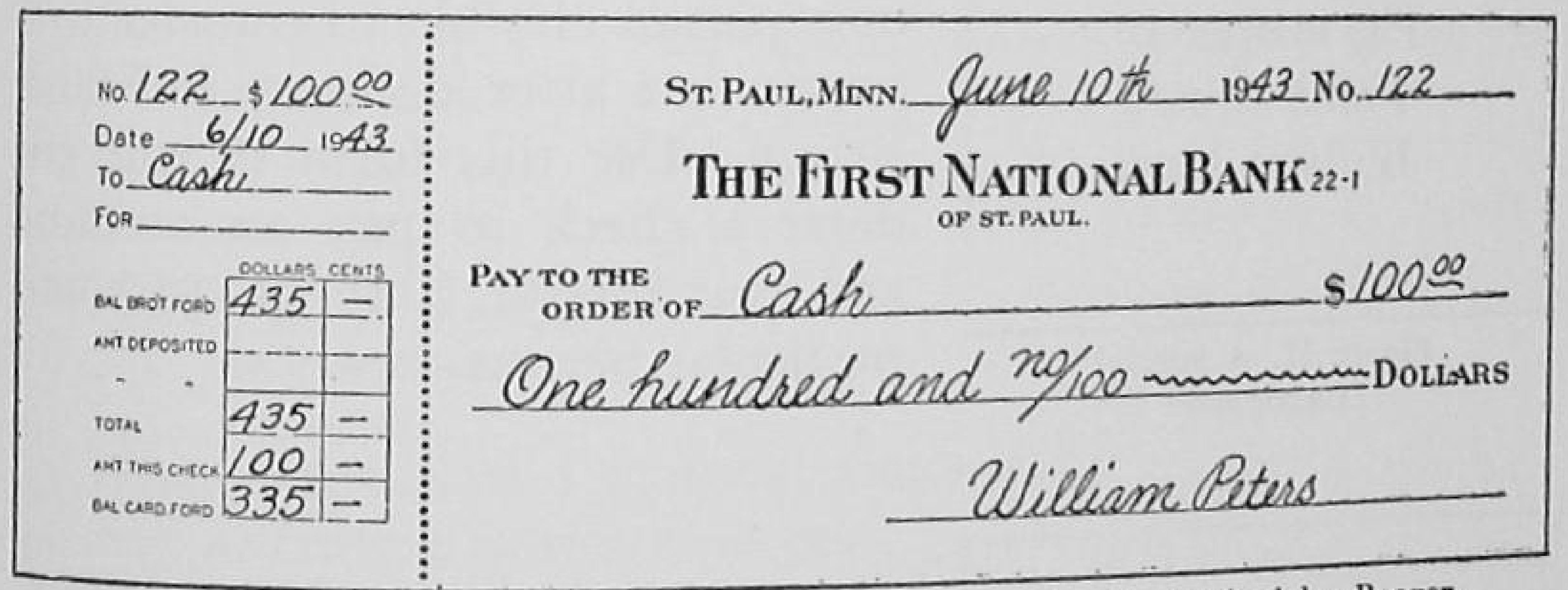
1. Check your balances regularly, to avoid overdrawing your account.
2. Examine carefully your monthly statement and reconcile canceled checks with entries on the stubs.
3. Retain all canceled checks for at least ten years.


No. 121 $25.00
Date 6/10 1943
To John Jones
For Wages

	Dollars	Cents
Bal. Bro't Forw'd	441	–
Am't Deposited	19	–
Total	460	–
Am't This Check	25	–
Bal. Car'd Forw'd	435	–

St. Paul, Minn. June 10th 1943 No. 121
THE FIRST NATIONAL BANK 22-1
OF ST. PAUL.
Pay to the order of John Jones $25.00
Twenty-five and no/100 Dollars
William Peters

Figure 38. A Nonnegotiable Bank Check.


No. 122 $100.00
Date 6/10 1943
To Cash
For

	Dollars	Cents
Bal. Bro't Forw'd	435	–
Am't Deposited		
Total	435	–
Am't This Check	100	–
Bal. Car'd Forw'd	335	–

St. Paul, Minn. June 10th 1943 No. 122
THE FIRST NATIONAL BANK 22-1
OF ST. PAUL.
Pay to the order of Cash $100.00
One hundred and no/100 Dollars
William Peters

Figure 39. An Inadvisable Bank Check That May be Cashed by Bearer.

The check shown in Figure 39 is payable to bearer. The word "cash" means to pay to anyone holding the check. Outside of cashing a check at a bank, checks should not be made payable to cash, since, if lost, anyone finding the check could cash it. Some large companies, however, will ask that checks be made payable to cash, when cash is actually paid out. The reason for this request is that it gives them a record of the nature of the transaction.

ENDORSEMENTS. Checks are usually negotiated from person to person by endorsement. The endorsement must be written on the instrument itself, or upon a paper attached thereto. The signature of the endorser without additional words is a sufficient

endorsement. There are four types of endorsement as shown by the following illustrations.

The endorser of a check should remember when he accepts it that he must stand loss of the face amount of the check should the bank upon which it is drawn refuse to honor the signature of the drawee. He may get a measure of protection by signing a non recourse endorsement. See Figure 42.

Each example represents a portion of the back of a check or note:

William Jones

Figure 40. A Blank Endorsement.

A Blank Endorsement. Under this type of endorsement the instrument becomes payable to bearer.

Pay to order of
Frank Brown
William Jones

Figure 41. A Special Endorsement

A Special Endorsement. The only person eligible to transfer this instrument after delivery is Frank Brown. Use this form if you endorse a check to pay an account and you intend it to go to some particular person.

Without recourse
William Jones
or
Pay to Frank Brown
without recourse
William Jones

Figure 42. A Qualified Endorsement

A Qualified Endorsement. This type of endorsement exempts the endorser from any liability upon it; however, this does not impair the negotiability of the paper. It merely offers a measure of protection to the endorser in case of a forged endorsement or a forged signature of the maker.

ALTERATIONS. "Where a negotiable instrument is materially altered without the assent of all parties liable thereon, it is void,

except as against a party who has, himself, made, authorized or assented to the alteration and subsequent endorsers."

Pay to Frank Brown
for collection
William Jones

Figure 43. A Restrictive Endorsement

A Restrictive Endorsement. This shows that William Jones owns the paper, and practically prohibits further negotiation, except for collection only. Another use frequently made of this type of endorsement is "Pay to the First National Bank for deposit only."—William Jones.

William Jones
Frank Brown
Pay to order of J. J. May
Frank Brown
J. J. May
Mary Carlson
etc.

Figure 44. A Multiple Endorsement

A Multiple Endorsement. Negotiable instruments may be endorsed many times as indicated in the example.

What constitutes a material alteration?

Any alteration which changes:

1. The date.
2. The sum payable, either principal or interest.
3. The time or place of payment.
4. The number or the relations of the parties.
5. The medium or currency in which payment is made or which adds a place of payment where no place of payment is specified.

Any other change or addition which alters the effect of the instrument in any respect is a material alteration.

When one makes out a check or note, or accepts such paper, one should make certain that it is properly filled in and that no alterations appear on it.

Present Checks Promptly. As will be noted from the illustration previously shown, a check is a bill of exchange drawn on

a bank, payable on demand. A check must be presented for payment within a reasonable time after its issue or the drawer will be discharged from liability thereon to the extent of the loss caused by delay. While a check does not extinguish a debt until the check is paid, failure to present it within a reasonable time might seriously affect the drawer, as in the case of bank failure. The negligence of the holder of the check might by his act prevent the payment of the check and, under such circumstance, he should suffer the consequences.

The rule generally followed is to present the check for payment within the next business day. Distance from the bank, custom of the locality, and the nature of the instrument enter into the determination as to what is "a reasonable time."

CERTIFIED CHECKS. In certain transactions, a certified check is sometimes required. For example, if one sold either personal or real property to a stranger and accepts a check in payment, he can insure payment of the check by requiring it to be certified. The drawer would write his personal check, take it to the bank and have it certified. The bank would immediately set aside the amount of money necessary to honor the check when presented for payment and would stamp across the face of the check the words, "Certified for Payment." Certification by the bank is equivalent to acceptance.

Where the holder has the check certified, however, all endorsers are discharged from liability. In that event, if the bank became insolvent before the check was presented for payment, the holder must look to the bank for payment. If, on the other hand, the drawer had the check certified before delivery of the check and the bank failed, the drawer could be held for payment.

CASHIERS' CHECKS. Cashiers' checks are sometimes referred to as bankers' checks. If one purchases a cashier's check, the bank makes its check payable to the party named by the purchaser. The purchaser's name, unless the instrument is addressed to him, does not appear on the check. This type of check is generally readily accepted by business houses.

OVERDRAFTS. While a checking account is a convenient arrangement for payment of money, it is sometimes abused. Careless persons issuing checks without regard to maintaining proper bank balances may overdraw their account and have their checks returned unpaid with the notation "Nonsufficient Funds." Issuing checks in this manner is not only embarrassing but is also in

violation of the law, subjecting the drawer to certain prescribed penalties. It is, therefore, important to keep an accurate record of all bank balances.

POST-DATED CHECKS. The practice of post-dating checks is sometimes followed, such as issuing a check today, dated a month hence. Often creditors in pressing for payment, may ask that a check dated in advance be given. In some states such a check is treated as a promissory note. If funds are not in the bank to meet the obligation at the time of presentation, the checks will be marked "NSF." If considered as a promissory note, the result would be the same as defaulting in payment on an ordinary note. In any event, the practice is not a desirable one to follow. If funds are not sufficient when due to meet payment it is better to give a note than a post-dated check, thus keeping the account straight and maintaining a better banking record.

INSTALLMENT BUYING OF GOODS

Installment buying is a method of purchasing goods on the deferred payment plan. It is used extensively in this country. The types of instruments usually associated with purchases made in this manner are conditional sales contracts or chattel mortgages. In purchasing a tractor under a conditional sales contract, title in the tractor does not pass to the purchaser until all the installments have been paid.

One of the disadvantages associated with purchases of this sort lies in the uncertainty of ownership. If you pay, let us say, half of the installments and are unable to pay further, the seller may retake the tractor. You are never sure of ownership until the final payment is made. The convenience to the seller in the use of this instrument lies in the fact that he has retained title and, upon default, may retake with a minimum of legal proceedings. Most states, however, allow the original purchaser a short waiting period within which time he may redeem or, upon resale, provide for repayment of any equity he may have, which, in most cases, is little or nothing.

The second disadvantage pertains to cost. Usually the seller requires a carrying charge. Often this charge is excessive from the purchaser's viewpoint. For example, five per cent on the unpaid balance will mean actually payment of approximately ten per cent, since the purchaser, if it is a monthly contract, is paying off portions of the principal sum each month while the five per cent rate is assessed at the time of entering the contract

on the total unpaid balance. This high interest rate from the seller's viewpoint is justified, since such transaction involves extra office work and, in some cases, losses on certain sales made under this plan.

CHATTEL MORTGAGES. Purchasing under a chattel mortgage on this plan is in effect the same thing; but, where a chattel mortgage is given, the purchaser must first acquire title and then, under the chattel mortgage, he sells, assigns, transfers all his right title and interest in and to the property on condition that, if he carries out all the agreed undertakings, the mortgage shall be of no effect. If all the payments are made, the mortgagor regains full title; if he fails, the mortgagee may foreclose the mortgage in the manner prescribed by law and thus obtain clear title to the goods. Both plans of purchases create uncertainty in ownership, which is undesirable from the purchaser's viewpoint. Many articles of goods, however, are purchased and paid for in this manner—goods perhaps which could not otherwise be acquired. Before buying on mortgage one should answer the following questions in the affirmative:

1. Are the goods purchased necessary?
2. Will they be productive by saving time or labor and will such effort produce a profit or a means of paying for them?

Luxuries should not be purchased on the time payment plan.

Some of the points made here will be clarified by reading with care the language and content of the conditional sales contract and chattel mortgage forms used in the community. Also, the manner of filing these instruments should be inquired into, since such filing and recording give notice to all of the rights and interests of the parties.

In purchasing chattels from individuals who are not known, a careful and prudent person will check the records in the recording office to make certain there are no mortgages or liens against the goods purchased. This rule applies to the purchase of livestock, machinery, and other equipment used by the farmer.

APPENDIX

APPENDIX

MEASURING AND MAPPING A FARM

Most farms can be measured and mapped quite satisfactorily by an untrained person using relatively simple methods. The most accurate results, of course, can be obtained by a trained engineer using good instruments. A measuring wheel equipped with a revolution counter or a surveyor's steel tape is the most satisfactory for making the measurements. A light rope or very stout string, with knots tied in it to indicate units of measurement, can be used if necessary. A rope or string four rods in length will be convenient. When using a tape or string, pieces of heavy wire about eighteen inches long, pointed at one end and bent into a loop two inches in diameter at the other, will make convenient markers. Some brightly colored cloth should be tied in the loops to make it easier to find them. Two men are needed when a tape or string is used, one at each end. The measurements can also be obtained by pacing, although this method is less accurate. Some paper on which to record measurements and notes, cross-section paper or other drawing paper on which to draw the map, sharp pencils, and a good ruler will also be needed.

The procedure for measuring and mapping can best be explained by referring to the farm for which a map is presented in Figure A. This is a forty-acre farm, with roads along the west and north sides. The half of the road belonging to the farm extends to the dotted line; the other half of the road belongs to the adjoining property.

Measure first the boundaries of the farm. Start in the middle of the road in the northwest corner, at the point indicated by A on the map. If there had been no road here, the measurements would have been started at the corner post. Measure the distance from the middle of the west road, A, to a point in line with the fence along the road, marked B. Record this measurement on the paper used for that purpose, along with a description of the item measured, as "2 rods, center of west road to fence." Then measure the distance from the fence to the west edge of the farmstead, again recording the measurement and description, as "28¼ rods, west road to west side of farmstead." Measurements should be taken at every point where a fence line or field division extends

out to the boundary line. Measurements should also be taken at any point where it is possible to sight along some fence line or field division located within the farm, as at G, where it is possible to sight along the fence running from E to F.

If a tape or string is used or if the distances are measured by pacing, it will usually be most convenient to measure the distance from one point to the next, as 2 rods from A to B, 28¼ rods from B to C, and 9¾ rods from C to D. If a measuring wheel is used, it will usually be most convenient to set the counter at zero at the starting point and then determine the measurements from this point to each of the other points, as 2 rods to B, 30¼ rods to C, and 40 rods to D. It will then not be necessary to reset the counter each time that a measurement is taken. The counter should, however, be reset each time that a corner is turned.

After the boundaries of the farm have been measured, make a drawing, to scale, from the measurements that have been gathered. The scale used in Figure A is 20 rods to one inch. For general use, the scale should be such as to give a larger map than that shown. Draw first the outside lines for the farm. For this example these are the lines representing the middle of the road on the west and north sides and the boundary fences on the east and south sides. Place along these lines dots to represent the measurements that have been taken, locating them in the correct places according to the scale used. From these dots can then be drawn the fence lines along the road and the fence running north and south through the middle of the farm. By laying the ruler so that the edge runs over the point marked E and the point marked G, the fence line between fields 2 and 3 can be drawn.

Additional measurements must be taken in order to be able to draw the remainder of the map. Measure the west, south, and east sides of the farmstead and the width of the lane at the north end. Add this measurement to the drawing that has already been made. Then measure the distance from F to K and the width of the lane at K. Measuring the curved line separating fields 1 and 4 is somewhat more difficult. The method used for measuring such a line is illustrated in Figure B, which shows the same line. Start at K and measure along a straight line toward L, as shown by the dotted line. At frequent intervals, 10-rod intervals were used for this farm, make marks in the ground, by setting one of the wire markers, or by kicking small holes. From these marks measure to the left at right angles to the straight line from K to L. The distance was 7 rods for the first such measurement. From

these measurements locate on the map the points along the boundary to which the measurements were taken. The curved line can then be drawn on the map by joining these points. The lane can then be drawn from the farmstead to the line between fields 1 and 4, completing the drawing of the map.

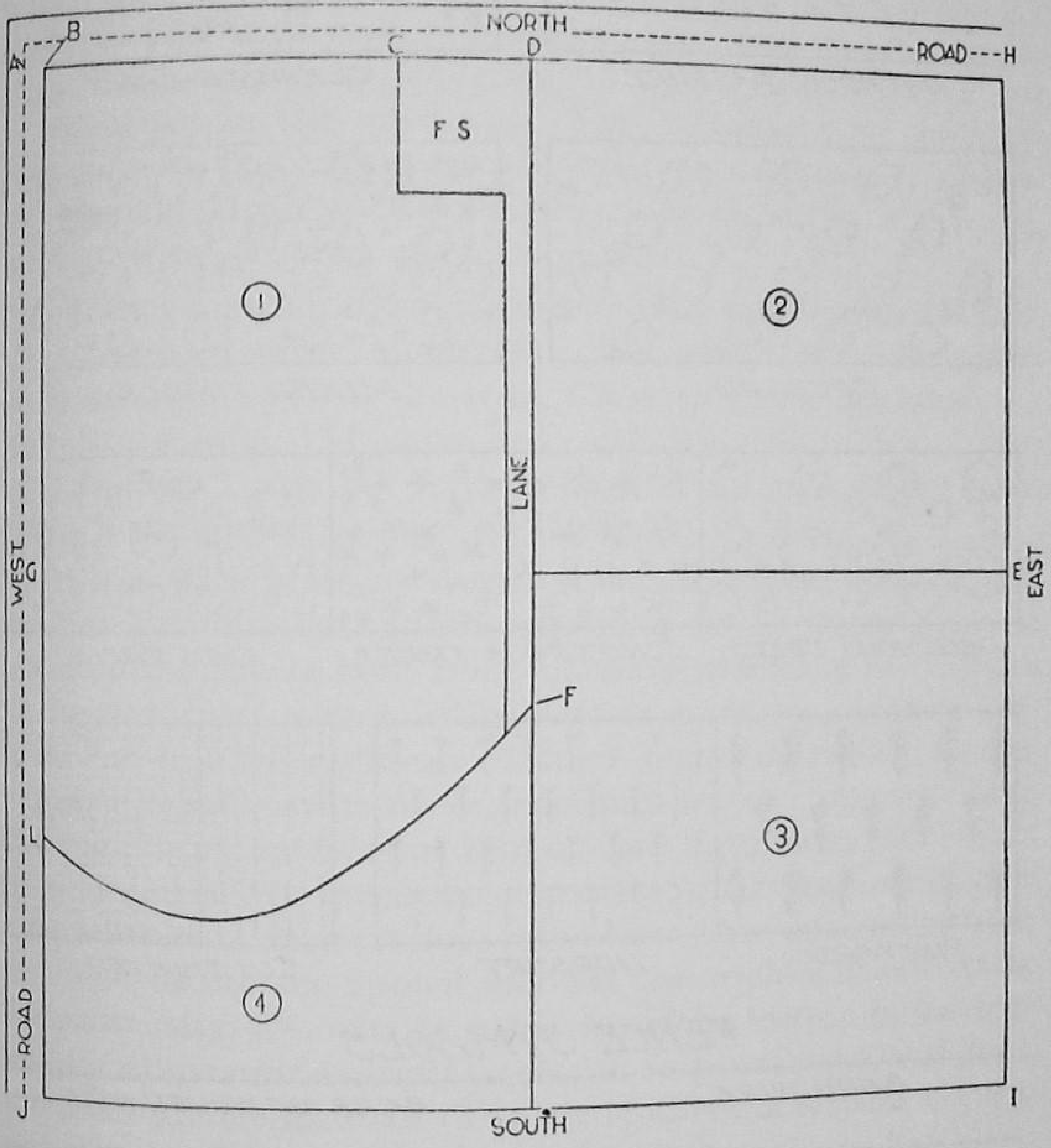


FIGURE A. HOW TO MEASURE AND MAP A FARM

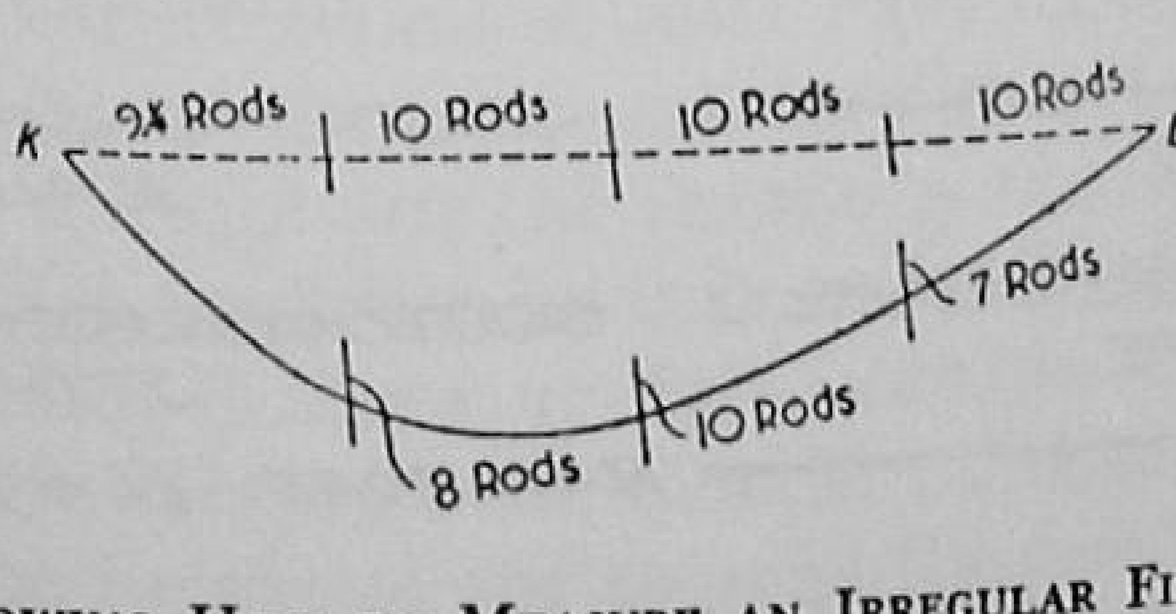


FIGURE B. SHOWING HOW TO MEASURE AN IRREGULAR FIELD SUCH AS THE SIDE OF FIELD NO. 1

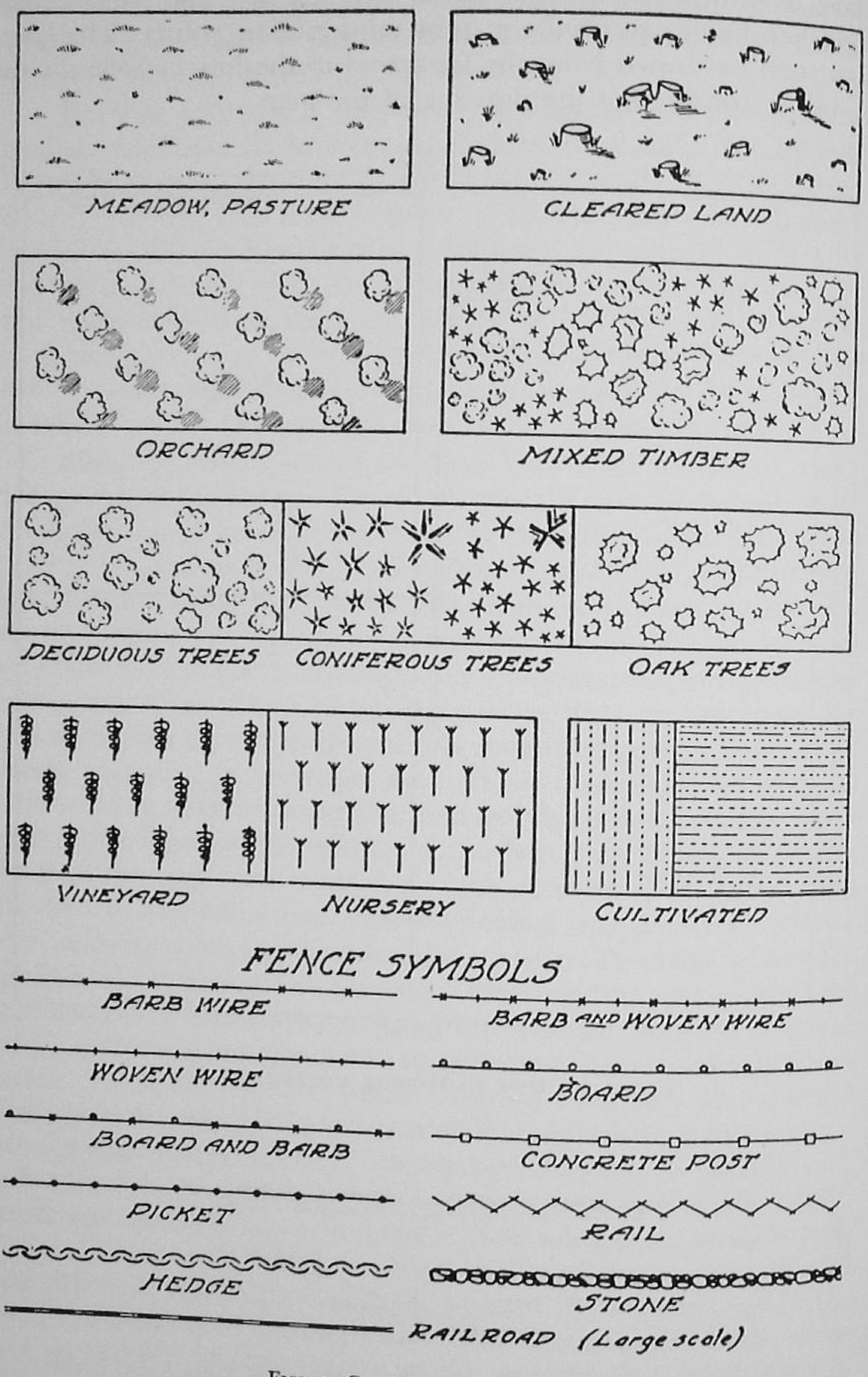


FIGURE C. CULTURE SYMBOLS

The remaining problem is then to calculate the acreages of each field and of the road, farmstead, and lane. For rectangular fields, multiply the length times the width to obtain the square rods or square feet. One acre is 160 square rods, or 43,560 square feet. For example, the road is 158 rods long and 2 rods wide, or a total area of 316 square rods; 316 divided by 160, is almost 2.0 acres. Field 2 is 38 rods wide and 40 rods long, or 1,520 square rods; 1,520 divided by 160 gives 9.5 acres. All other fields can be calculated in the same way. The calculations for the fields with irregular boundaries are somewhat more difficult. It is necessary to divide them up into small sections, rectangles or triangles, calculating the acreages of each separately.

Adding together the acreages of all the fields supplies a check on the accuracy of the calculations. The acreages of the individual items are: 2.0 acres in the road, 0.6 acres in the farmstead, 0.5 acres in the lane, 13.0 acres in field 1, 9.5 acres in field 2, 10.0 acres in field 3, and 4.4 acres in field 4, or a total of 40.0 acres, which is the correct acreage for the farm.

Using Base Maps of Farm. After the original base map has been prepared, several additional copies can be made for use in planning the future land use program of the home farm. Some of the important factors to consider in planning a land-use program are: soil types, degree of slope, degree of erosion, fertility and lime requirements of soil, and present crop program. Then there are other features of interest and significance that should be shown on one or more of the base maps. Among these features are streams, ditches, swamps, rocky places, woodlots, gullies, trees, etc. In locating the special features the symbols shown in the Appendix page 474, may be used. An added interest in the map-making will come from using color to show soil types, acid areas, and other surface features. The use of colors in symbols will also add appeal and increased value to the maps.

RULES FOR MEASURING GRAIN IN BINS

(1) To Measure Grain in Bin: Take measurement of length, width, and height of the grain in the bin and obtain total cubic feet of grain by multiplying the length by the width by the height. Divide by 1¼ (or multiply by 0.8) to find bushels.

(2) To Find Bushels of Ear Corn in Crib: Rectangular Crib–Find cubic feet of corn in crib by multiplying length by the width by the height of the corn in the crib and divide by 2½ (or multiply by 0.4) to find bushels. Round Crib–Find cubic

feet of corn in crib by multiplying distance around crib by 2/25 of that distance by height of corn in crib and divide by 2½ (or multiply by 0.4) to find bushels.

CUBIC FEET OF HAY PER TON

Many factors affect the density of hay in the stack and therefore the number of cubic feet required for a ton of hay. The factor that causes the greatest variation is probably moisture in the hay at stacking time. Tough or slightly undercured hay will settle and become more compact than very dry or overcured hay. Other factors like texture and foreign material may affect the density also, but probably not to the same extent as moisture. For these reasons there is often a considerable difference in the number of cubic feet required for a ton in different stacks, and, at present, there are no simple methods for measuring variations in density.

The following figures, which are the averages obtained from a large number of stacks, can be used with fairly good results:

Kind of hay	Length of time in stack	
	30 to 90 days	Over 90 days
Alfalfa	485 cubic feet per ton	470 cubic feet per ton
Timothy and timothy mixed	640 cubic feet per ton	625 cubic feet per ton
Wild	600 cubic feet per ton	450 cubic feet per ton

RULES FOR ESTIMATING WEIGHT OF HAY IN MOWS OR STACKS

To find tons of hay in mow or stack. The usual procedure is to determine the contents of the mow or stack in cubic feet.
a. To determine cubic contents:

1. Hay mows—multiply the width by the length by the height, in feet.

2. Hay stacks (from leaflet No. 72 U. S. D. A., Measuring hay in stacks).

Rules for Measuring Oblong Stacks

For square, flat-topped stacks.... $(0.56 \times 0) - (0.55 \times W) \times WL$.
For high, round-topped stacks.. $(0.52 \times 0) - (0.46 \times W) \times WL$.
For low, round-topped stacks.... $(0.52 \times 0) - (0.44 \times W) \times WL$.

In these rules 0 equals the over, W equals the width, and L equals the length.

Example

To determine the volume of a rectangular stack of the high,

round-topped type that is 20 feet wide, 45 feet over, and 50 feet long.

Volume = (0.52 × 45) – (0.46 × 20) × (20 × 50).

```
  45              20              50
  0.52            0.46            20
  ----            ----            -----
    90            9.20            1,000
  225
 -----
 23.40
 -9.20
 -----
 14.20
     1,000
 ---------
 14,200.00 cubic feet in the stack.
```

Rules for Measuring Round Stacks

Volume = (0.04 × 0) – (0.012 × C) C^2. In this formula C equals the circumference or distance around the stack at the ground and 0 equals the over or distance from the ground on one side over the peak to the ground on the other side. Usually it is advisable to take two over measurements at right angles to each other, and to average them.

Example

To determine the volume of a round stack that is 100 feet in circumference and has an average over of 60 feet.

Volume = (0.04 × 60) – (0.012 × 100) × $(100)^2$.

```
  60              100             100
  0.04            0.012           100
  ----            -----           ------
  2.40            200             10,000
 -1.20            100
 -----            -----
  1.20            1.200
     10,000
 ---------
 12,000.00 cubic feet in the round stack.
```

To simplify the finding of the volume of hay in round stacks of specified dimensions, Appendix Table I will be helpful where the stacks are from 52 to 98 feet in circumference.

APPENDIX TABLE I—VOLUME OF HAY IN ROUND STACKS OF SPECIFIED DIMENSIONS
(Volume figures given to the nearest 5)

Circumference (feet)	Indicated volume in cubic feet when the over is— 38 feet	39 feet	40 feet	41 feet	42 feet	43 feet	44 feet	45 feet	46 feet	47 feet	48 feet	49 feet	50 feet
45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
52	2,665	2,795	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
53	2,700	2,835	2,975	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
54	2,735	2,875	3,015	3,160	.....	.....	.....	.....	.....	.....	.....	.....	.....
55	2,770	2,915	3,060	3,210	3,360	3,505	.....	.....	.....	.....	.....	.....	.....
56	2,805	2,955	3,105	3,255	3,415	3,565	3,720	.....	.....	.....	.....	.....	.....
57	2,845	2,995	3,150	3,305	3,465	3,625	3,785	3,940	.....	.....	.....	.....	.....
58	2,880	3,035	3,195	3,350	3,515	3,680	3,850	4,010	4,175	.....	.....	.....	.....
59	2,915	3,075	3,235	3,400	3,570	3,740	3,915	4,080	4,245	4,415	.....	.....	.....
60	2,950	3,115	3,280	3,445	3,625	3,795	3,975	4,150	4,320	4,490	4,670	.....	.....
61	2,985	3,155	3,325	3,495	3,675	3,855	4,040	4,215	4,390	4,570	4,750	4,925	.....
62	3,020	3,195	3,365	3,540	3,730	3,915	4,105	4,285	4,465	4,650	4,830	5,015	5,200
63	3,055	3,235	3,410	3,585	3,780	3,970	4,165	4,355	4,540	4,730	4,910	5,105	5,295
64	3,090	3,275	3,455	3,635	3,835	4,030	4,230	4,425	4,615	4,805	4,995	5,195	5,390
65	3,125	3,315	3,495	3,680	3,885	4,085	4,290	4,490	4,690	4,885	5,075	5,285	5,485
66	3,160	3,355	3,540	3,730	3,935	4,145	4,355	4,560	4,760	4,960	5,160	5,370	5,580
67	3,195	3,395	3,585	3,780	3,990	4,205	4,420	4,630	4,830	5,040	5,245	5,460	5,670
68	3,230	3,430	3,630	3,825	4,045	4,265	4,485	4,695	4,900	5,120	5,330	5,550	5,765
69	3,265	3,470	3,670	3,875	4,095	4,320	4,545	4,760	4,970	5,195	5,415	5,640	5,860
70	3,300	3,510	3,715	3,920	4,150	4,375	4,610	4,825	5,045	5,275	5,495	5,730	5,955
71	3,335	3,550	3,760	3,970	4,205	4,435	4,670	4,895	5,120	5,355	5,580	5,820	6,050
72	3,375	3,590	3,805	4,015	4,255	4,495	4,735	4,965	5,195	5,435	5,665	5,910	6,145
73	3,410	3,630	3,845	4,065	4,310	4,550	4,795	5,030	5,270	5,515	5,750	6,000	6,240
74	3,445	3,665	3,890	4,110	4,360	4,610	4,855	5,095	5,340	5,595	5,835	6,090	6,335
75	3,480	3,705	3,935	4,160	4,415	4,670	4,915	5,165	5,415	5,675	5,915	6,180	6,430
76	3,515	3,745	3,975	4,205	4,465	4,725	4,980	5,235	5,490	5,750	6,000	6,270	6,525
77	3,550	3,785	4,020	4,250	4,520	4,785	5,045	5,305	5,560	5,830	6,085	6,355	6,620
78	3,585	3,825	4,065	4,300	4,570	4,840	5,105	5,370	5,635	5,910	6,170	6,445	6,715
79	3,620	3,865	4,105	4,345	4,625	4,895	5,170	5,440	5,710	5,990	6,255	6,535	6,810
80	3,655	3,905	4,150	4,395	4,675	4,955	5,235	5,510	5,785	6,070	6,340	6,625	6,905
81	3,690	3,945	4,195	4,440	4,730	5,010	5,295	5,575	5,855	6,145	6,425	6,715	7,000
82	3,725	3,985	4,240	4,490	4,785	5,070	5,360	5,645	5,930	6,225	6,510	6,800	7,090
83	3,760	4,025	4,280	4,535	4,830	5,130	5,425	5,715	6,005	6,305	6,595	6,890	7,185
84	3,795	4,065	4,325	4,580	4,885	5,190	5,485	5,785	6,080	6,385	6,675	6,980	7,280
85	3,830	4,105	4,365	4,630	4,935	5,245	5,550	5,850	6,155	6,465	6,760	7,070	7,375
86	3,865	4,145	4,410	4,675	4,990	5,300	5,615	5,920	6,230	6,545	6,845	7,160	7,470
87	3,900	4,185	4,455	4,725	5,040	5,360	5,680	5,990	6,300	6,620	6,930	7,250	7,565
88	3,940	4,220	4,500	4,770	5,090	5,420	5,745	6,060	6,375	6,700	7,015	7,340	7,660
89	3,975	4,260	4,540	4,815	5,145	5,475	5,805	6,125	6,450	6,780	7,100	7,430	7,755
90	4,010	4,300	4,585	4,860	5,200	5,535	5,865	6,195	6,525	6,860	7,185	7,520	7,845
91	4,045	4,340	4,630	4,910	5,250	5,595	5,930	6,265	6,600	6,940	7,270	7,605	7,940
92	4,080	4,380	4,670	4,955	5,305	5,650	5,995	6,335	6,675	7,020	7,355	7,695	8,035
93	.....	4,420	4,715	5,005	5,360	5,710	6,055	6,400	6,750	7,095	7,440	7,785	8,130
94	.....	4,460	4,760	5,050	5,410	5,765	6,120	6,470	6,825	7,175	7,525	7,875	8,225
95	.....	.....	4,805	5,100	5,465	5,825	6,180	6,540	6,895	7,255	7,610	7,965	8,320
96	.....	.....	.....	5,150	5,515	5,885	6,245	6,610	6,970	7,335	7,695	8,055	8,415
97	.....	.....	.....	5,195	5,570	5,945	6,310	6,680	7,045	7,415	7,780	8,145	8,510
98	.....	.....	.....	.....	5,625	6,000	6,370	6,750	7,120	7,495	7,865	8,235	8,605

APPENDIX TABLE II—CAPACITY OF SILOS AND WEIGHTS OF SILAGE
ESTIMATED TONNAGE OF SILAGE AT THE TIME FILLING IS COMPLETED

Depth of silage	Diameter of silo in feet						
	10	12	14	16	18	20	22
Feet	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1	0.6	1.0	1.2	1.6	2.1	2.5	3.1
2	1.3	1.9	2.6	3.4	4.3	5.3	6.4
3	2.1	3.0	4.2	5.3	6.7	8.3	10.1
4	2.9	4.2	5.7	7.4	9.4	11.6	14.0
5	3.8	5.4	7.4	9.7	12.2	15.0	18.2
6	4.7	6.7	9.2	12.0	15.2	18.7	22.6
7	5.6	8.1	11.1	14.5	18.3	22.6	27.3
8	6.7	9.6	13.1	17.1	21.6	26.7	32.3
9	7.8	11.2	15.2	19.8	25.1	31.0	37.6
10	8.8	12.8	17.4	22.7	28.8	35.5	43.0
11	10.1	14.5	19.7	25.7	32.6	40.3	48.7
12	11.3	16.3	22.1	28.9	36.6	45.2	54.6
13	12.5	18.1	24.6	32.2	40.7	50.2	60.7
14	13.9	20.0	27.2	35.5	45.0	55.5	67.2
15	15.2	22.0	29.9	39.1	49.4	61.0	73.8
16	16.8	24.0	32.7	42.7	54.0	66.7	80.6
17	18.1	26.1	35.5	46.4	58.8	72.5	87.7
18	19.6	28.3	38.5	50.3	63.6	78.5	95.0
19	21.2	30.5	41.5	54.1	68.6	84.8	102.6
20	22.8	32.8	44.6	58.3	73.8	91.1	110.2
21	24.4	35.1	47.8	62.5	79.1	97.5	118.0
22	26.0	37.5	51.1	66.7	84.5	104.2	126.1
23	27.1	40.0	54.4	71.8	90.0	111.1	134.4
24	29.5	42.5	57.8	75.5	95.5	118.0	142.7
25	31.3	45.2	61.3	80.0	101.3	125.1	151.2
26	33.1	47.7	64.8	84.6	107.2	132.3	160.0
27	34.9	50.3	68.4	89.3	113.2	139.6	168.8
28	36.8	53.0	72.1	94.1	119.2	147.1	177.8
29	38.7	55.8	75.8	98.9	125.4	154.6	187.0
30	40.6	58.5	79.5	103.8	131.6	162.3	196.3
31	.....	61.3	83.4	108.8	137.9	170.1	205.8
32	.....	64.1	87.2	113.8	144.5	178.0	215.2
33	.....	67.0	91.1	118.9	150.8	186.0	225.0
34	.....	69.8	95.1	124.2	157.4	194.1	234.8
35	.....	.....	99.1	129.3	163.9	202.2	244.6
36	.....	.....	103.2	134.7	170.7	210.6	254.8
37	.....	.....	107.2	139.9	174.4	218.8	264.8
38	.....	.....	111.3	145.3	184.2	227.2	275.0
39	.....	.....	115.5	150.8	191.2	235.8	285.4
40	.....	.....	119.6	156.2	198.1	244.3	295.6
41	.....	.....	123.8	161.7	205.1	252.9	305.8
42	.....	.....	128.2	167.4	212.1	261.6	316.3
43	.....	.....	.....	172.9	219.2	270.2	326.9
44	.....	.....	.....	178.6	226.3	279.1	337.6
45	.....	.....	.....	184.2	233.6	288.0	348.4
46	.....	.....	.....	190.0	240.9	297.1	359.4
47	.....	.....	.....	195.8	248.2	306.2	370.4
48	.....	.....	.....	201.8	255.7	315.4	381.4
49	.....	.....	.....	207.7	263.2	324 6	392.5
50	.....	.....	.....	213.6	270.8	333 9	403.7

APPENDIX TABLE III—ESTIMATED WEIGHTS OF SETTLED SILAGE

Depth of silage	Weight of silage per cubic foot at this depth	Average weight of silage per cubic foot to this depth	Weight of settled silage					
			10-ft. diameter	12-ft. diameter	14-ft. diameter	16-ft. diameter	18-ft. diameter	20-ft. diameter
Feet	Pounds	Pounds	Tons	Tons	Tons	Tons	Tons	Tons
1	32.0	32.0	1.26	1.81	2.46	3.22	4.07	5.03
2	32.7	32.4	2.54	3.66	4.98	6.51	8.23	10.17
3	33.4	32.7	3.85	5.54	7.55	9.86	12.46	15.40
4	34.1	33.1	5.19	7.48	10.19	13.31	16.81	20.79
5	34.8	33.4	6.55	9.45	12.85	16.78	21.21	26.22
6	35.4	33.7	7.94	11.44	15.56	20.32	25.68	31.75
7	36.0	34.1	9.37	13.50	18.37	23.99	30.31	37.48
8	36.6	34.4	10.80	15.56	21.19	27.66	34.95	43.21
9	37.4	34.7	12.26	17.66	24.04	31.39	39.66	49.03
10	38.0	35.0	13.74	19.79	26.95	35.18	44.45	54.95
11	38.4	35.3	15.25	21.95	29.89	39.02	49.31	60.96
12	38.8	35.6	16.77	24.15	32.89	42.93	54.25	67.07
13	39.2	35.9	18.32	26.38	35.93	46.90	59.27	73.27
14	39.6	36.2	19.90	28.65	39.02	50.93	64.36	79.57
15	40.0	36.4	21.44	30.88	42.04	54.87	69.34	85.72
16	40.2	36.7	23.05	33.21	45.21	59.01	74.57	92.19
17	40.4	36.9	24.63	35.47	48.30	63.04	79.67	98.49
18	40.6	37.1	26.22	37.76	51.42	67.11	84.81	104.84
19	40.8	37.3	27.83	40.07	54.56	71.22	90.00	111.27
20	41.0	37.5	29.45	42.41	57.75	75.38	95.25	117.75
21	41.2	37.6	31.00	44.65	60.79	79.35	100.28	123.97
22	41.4	37.8	32.65	47.02	64.03	83.58	105.61	130.56
23	41.6	38.0	34.32	49.41	67.29	87.84	110.50	137.22
24	41.8	38.1	35.90	51.70	70.40	91.90	116.13	143.56
25	42.0	38.3	37.60	54.15	73.72	96.23	121.60	150.33
26	42.2	38.4	39.20	56.46	76.87	100.34	126.80	156.75
27	42.4	38.6	40.92	58.94	80.24	104.74	132.36	163.63
28	42.6	38.7	42.55	61.28	83.43	108.90	137.62	170.13
29	42.8	38.9	44.30	63.79	86.86	113.37	143.27	177.11
30	43.0	39.0	45.94	66.08	90.09	117.59	148.59	183.69
31	43.0	....	47.63	68.51	93.40	121.90	154.06	189.94
32	43.0	....	49.32	70.94	96.71	126.21	159.53	196.19
33	43.0	....	51.01	73.37	100.02	130.52	165.00	202.44
34	43.0	....	52.70	75.80	103.33	134.83	170.47	208.69
35	43.0	....	54.39	78.23	106.64	139.14	175.94	214.94
36	43.0	....	56.08	80.66	109.95	143.45	181.41	221.19
37	43.0	....	57.77	83.09	113.26	147.76	186.88	227.44
38	43.0	....	59.46	85.52	116.57	152.07	192.35	233.69
39	43.0	....	61.15	87.95	119.88	156.38	197.82	239.94
40	43.0	....	62.84	90.38	123.19	160.69	203.29	246.19
41	43.0	....	64.53	92.81	126.50	165.00	208.76	252.44
42	43.0	....	66.22	95.24	129.81	169.31	214.23	258.69
43	43.0	....	67.91	97.67	133.12	173.62	219.70	264.94
44	43.0	....	69.60	100.10	136.43	177.93	225.17	271.19
45	43.0	....	71.29	102.53	139.74	182.24	230.64	277.44

RULES FOR ESTIMATING WEIGHT OF SILAGE IN SILO

To Find Tons of Silage in a Silo—Use Appendix Table II for measuring silage immediately after filling and Appendix Table III for silage that has settled at least one month. The total amount of silage in silo can easily be determined from these tables if one knows the diameter of the silo and the depth of silage in it. If none has been removed the quantity can be obtained directly. If some has been fed off the amount remaining can be determined by subtracting from the total settled silage originally in the silo the amount fed off. For example, at inventory time a certain silo fourteen feet in diameter contains twenty feet of silage. Before feeding started in the fall it contained thirty feet of settled silage which weighed 90.09 tons as shown by Appendix Table III. The weight of 10 feet of silage, the amount removed, as indicated in Appendix Table III is 26.95 tons. Subtracting this from the original 90.09 tons leaves 63.14 tons, the quantity of silage at inventory time. Appendix Tables II and III are taken from Kansas Experiment Station Bulletin No. 222.

WEIGHTS AND MEASURES

AVOIRDUPOIS WEIGHT

16 ounces (oz.)	= 1 pound (lb.)
100 pounds	= 1 hundredweight (cwt.)
20 cwt.	= 1 ton (T.)
1 ton	= 20 cwt. = 2,000 lb. = 32,000 oz.

LINEAR MEASURE

12 inches (in.)	= 1 foot (ft.)
3 feet (ft.)	= 1 yard (yd.)
5½ yards or 16½ ft.	= 1 rod (rd.) or pole
40 rods (rds.)	= 1 furlong
8 furlongs	= 1 mile (mi.)
1,760 yards (yds.)	= 1 mile (mi.)
5,280 feet (ft.)	= 1 mile (mi.)
3 miles (mi.)	= 1 league
4 inches (in.)	= 1 hand (used in measuring height of horses)

SQUARE MEASURES

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
30¼ square yards	= 1 square rod (sq. rod)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

1 square mile	= 1 section
36 sections	= 1 township (twp.)
43,560 square feet	= 1 acre

SOLID OR CUBIC MEASURES

1,728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)
1 cubic yard	= 27 cu. ft. = 46,656 cu. in.
1 cubic yard	= 1 load
24¾ cubic feet	= 1 perch
128 cu. feet or 8′ x 4′ x 4′	= 1 cord
1 ft. x 12 in. x 1 in.	= 1 board foot

LIQUID MEASURES

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
31½ gallons	= 1 barrel (bbl.)
U. S. Gal.	= 231 cu. in.
7½ gallons of water	= 1 cu. ft. (approximately)

DRY MEASURES

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)
1 bushel	= 2150.42 cu. in.

WEIGHTS OF DAIRY PRODUCTS

Article	Specific Gravity	Weight of Gallon	Weight of Quart
		lb.	lb.
Pure water	1.000	8.342	2.085
Skimmilk	1.036	8.642	2.160
Whole milk	1.032	8.609	2.152
20% Cream	1.022	8.525	2.131
24% Cream	1.009	8.417	2.104
30% Cream	1.001	8.350	2.087
Pure Butter fat	0.910	7.591	1.898

APPENDIX TABLE IV—LEGAL WEIGHTS PER BUSHEL OF VARIOUS COMMODITIES

Commodity	Weights by states
Wheat	60 lbs. in all states having legal weights.
Oats	32 lbs. in all states having legal weights.
Barley	48 lbs. in all states having legal weights except California, 50; Mississippi, 60; Georgia & Kentucky, 47; Louisiana, 32.

APPENDIX TABLE IV—(*Continued*)

Commodity	Weights by states
Rye	56 lbs. in all states having legal weights except California, 54; Louisiana, 32.
Rice (rough)	45 lbs. in all states having legal weights except Georgia, 43; Maine, North Carolina & South Carolina, 44.
Buckwheat	48 lbs. in all states having legal weights except California, 40; North Dakota, 42; Alabama, Idaho, Minnesota, Nebraska, Nevada, North Carolina, Ohio, South Carolina, Tennessee & Wisconsin, 50; Arkansas, Colorado, Georgia, Illinois, Missouri, Montana, New Mexico, Oklahoma & Texas, 52; Kentucky, 56.
Flaxseed	56 lbs. in all states having legal weights except Connecticut & Vermont, 55.
Cottonseed	32 lbs. in all states having legal weights except Tennessee, 28; Georgia, North Carolina, South Carolina & Virginia, 30; Missouri, 33; Arkansas 33⅓.
Cottonseed (Sea Island)	44 lbs. in all states having legal weights.
Cottonseed (Upland)	30 lbs. in all states having legal weights.
Millet	50 lbs. in all states having legal weights except Minnesota, 48.
Corn (ear)	70 lbs. in all states having legal weights except Ohio & West Virginia, 68; Mississippi, 72.
Corn (shelled)	56 lbs. in all states having legal weights except California, 52.
Beans (dry)	60 lbs. in all states having legal weights.
Peas (dry)	60 lbs. in all states having legal weights.
Potatoes, white	60 lbs. in all states having legal weights except North Carolina, 56.
Potatoes, sweet	50 lbs. in all states having legal weights except North Dakota, 46; Connecticut, Maine, Mississippi, New Hampshire, Oregon, Pennsylvania, South Dakota, Rhode Island, Vermont & Wisconsin, 54; Alabama, Georgia, Kentucky, Minnesota & Oklahoma, 55; Florida, Michigan, Missouri, North Carolina & Virginia, 56; Maryland, 60.
Onions	57 lbs. in all states having legal weights except Pennsylvania, Rhode Island & Wisconsin, 50; Connecticut, Iowa, Maine, Minnesota, New Hampshire, North Dakota, South Dakota & Vermont, 52; Maryland & Michigan, 54; Kansas & West Virginia, 55; Florida, Ohio, South Carolina & Tennessee, 56.

APPENDIX TABLE IV—*(Continued)*

Commodity	Weights by states
Tomatoes	56 lbs. in all states having legal weights except Missouri & Oklahoma, 45; Iowa, Minnesota, New Mexico, North Dakota & South Dakota, 50; Maryland & Virginia, 60.
Apples	48 lbs. in all states having legal weights except Maine, Vermont & Wisconsin, 44; Montana, New Mexico & Pennsylvania, 45; Illinois, 47; Alabama, Arkansas, Maryland, Minnesota, North Dakota, South Carolina, Tennessee & Texas, 50.
Alfalfa Seed	60 lbs. in all states having legal weights.
Clover Seed	60 lbs. in all states having legal weights.
Timothy Seed	45 lbs. in all states having legal weights except Arkansas, 60.
Blue-grass Seed	14 lbs. in all states having legal weights except Nebraska, 18.
Orchard-grass Seed	14 lbs. in all states having legal weights.

INDEX

INDEX

ABSTRACT OF TITLE, 437
Accounts, accrual method, 354
  cash method, 354
  double-entry, 345
  single-entry, 345
Adams, R. L., 19, 21
Agricultural Adjustment Act, 427
  Administration, 116, 426
Agricultural production areas, 54-70
  Columbia Plateau Wheat Region, 69
  Corn and Winter Wheat Belt, 64
  Corn Belt, 65
  Cotton Belt, 63
  Grazing and Irrigated Crop Region, 68
  Hard Winter Wheat Belt, 65
  Hay and Dairy Region, 66
  Humid Sub-Tropical Belt, 63
  North Pacific Forest, Hay and Pasture Region, 69
  Pacific Sub-Tropical Crop Region, 70
  Truck Crop Belt, 63
  Western Forest and Hay Region, 69
Alternate lines of production, 217
  methods of production, 217
  plans of production, 217
Animal feeds, 327
  food products, 322
  power, 308
  specialty farms, 90
App, Frank, 21
Assets, changes in, 236
Automobile costs, 207

BAILEY, L. H., 18
Bank checks, 463
  for Co-operatives, 364, 365, 368
  credit, 363, 368
Barley production, 47
Barns, 302
Beef-cattle raising, 94
Bond, M. C., 21
Borrowing, 358, 371
Boss, Andrew, 14, 15, 16, 18, 20
Budgeting farm business, 198-212
Budget method of analysis, 20, 214
Buffum, B. C., 12
Buildings, arrangement, 162
  efficiency in, 251
  in relation to farm, 301
Bureau of Agricultural Economics, 19, 20
Butter marketing, 404
Buying, a farm, 434
  associations, 339

CAPITAL IN FARMING, 171, 355
  needs, 355
  values, 206
Carson, J. W., 12
Case, H. C. M., 19
Cash-and-crop-share lease, 109
Cash expenses, 342
  grain farming, 86
  lease, 111
  receipts, 342, 346
  records, 346
Cereals, 320
Chattel mortgages, 373, 458, 468
Checks, bank, 463
  cashier's, 466
  certified, 466
  post-dated, 467
Climate, 31, 55, 59, 89
Commodity Credit Corporation, 365
Commission, on sales, 402
Concentrates, 331
Concentration yards, 402

Contract, earnest-money, 435
  farm lease, 448
  for deed, 443
  forms and terms of lease, 107
  share lease, 107

Cooper, Thomas P., 17

Co-operative buying association, 339
  creameries, 404
  education, 398
  egg markets, 407
  marketing, 338, 391
  organization, 394
    financing, 394
    legal requirements, 394
    manager's responsibilities, 397
    member's responsibility, 396
    vs. corporation, 393
  Rochdale principles, 394
  selling, 338
  services, 416
    farm management specialist, 416
    financial support, 417
    results, 417

Cornell University, 13, 14, 18

Corn Belt, 31, 65, 76, 132
  production, 47

Cost-of-production records, 353

Costs, automobile, 207
  labor, 207
  law of comparative, 74
  machinery, 204
  replacement, 206
  truck, 205

Cotton Belt, 31, 63
  farming, 87
  marketing, 408

County production programs, 429

Creameries, 404

Credit, bank, 363
  Federal co-operative agencies, 364
  individual as source, 362
  in farming, 355
  insurance company loans, 364
  seller as source, 361

Crop-and-livestock combination, 276
  share lease, 109

Cropping plan, 193

Crop production, adaptation, 58, 182
  areas, 61
  index, 245
  in U. S., 48
  management, 125-147
  rotation, 133, 164, 193
  selection, 136
  wealth created in, 49
  yields, 248

Crops, choice, 245
  classified, 133
  cultivated, 134
  forage, 329
  grain, 134
  grass, 134

Crop-share leases, 108

Crop-specialty farming, 89

Cultivated crops, 134

Cunningham, L. C., 21

Curtis, G. W., 12

DAIRY FARMING, 91-94
  products, 322
    marketing, 403
  region, 61, 66, 91
  returns, 305

Deed, contract for, 443
  execution of, 443
  joint tenancy, 440
  quitclaim, 440
  recording, 443
  tenants in common, 440
  warranty, 439, 441

Demand, 384

Distribution, 387

Drainage, 126

EARNEST-MONEY CONTRACT, 435

Earnings, affected by management, 243
  measures of, 349
  variations in, 242

Economics of Farm Organization and Management, C. L. Holmes, 21, 74, 77

Economic factors, 73

Efficiency in buildings, 251
in farm layouts, 278
in feeding, 250, 293
in labor, 250
in machinery, 251
in potato picking, 291
in power, 251
in production, 249
in tomato picking, 290
of operation, 255

Egg markets, cooperative, 407
storage, 407

Electric power, 310

Elements of Farm Management, John A. Hopkins, 21

Endorsements, 463

Equipment for economic operation, 301

Expense, cash, 342
household, 238
personal, 238

FACTOR ANALYSIS, 243-267

Farm—
and home supplies, 319
assets, 236
budget, 119, 198, 214
buildings, 162, 301
business, organization of, 245
size of, 244
unit, 171
capital, 171
labor, 172
land, 171
management, 172
buying, 434
definition of, 3
duties, 35
fences, 168
house, 161, 302
implements, 310
income, 27
inventories, 342

Farm—*Continued*
land area, 41
layouts, efficient, 192, 278
lease contracts, 107, 448
location, 30
machinery, 204, 233, 310
management, 3, 7
and art, 4
and business, 6
and science, 5
development in U. S., 11
instruction, 13, 20
research, beginnings, 12
organized, 15
survey method, 18
services, 19, 415
Farm Bureau, 19
success factors, 252
manager, 8
mapping, 175, 471
organization, 160, 173, 187, 245
ownership, 100
partnership, 103
annual settlement, 105
produce records, 344
products, packaging, 387
record books, 344
records, 341
self-sufficing, 79
shop, 318
time to buy, 115
unit, organization, 170
value based on income, 117
work, 276
worth of, 116

Farm Bureau Farm Management Service, 19

Farm Credit Act, 364
Administration, 364, 365

Farm Economics, Management and Distribution, F. App, 21

Farmer and His Farm, The, App and Woodward, 21

Farmers Home Administration, 370

Farmers Union Grain Terminal Association, 392

Farming—
characteristics of, 23, 77
income from, 27, 37, 50
nature of, 23
responsibilities of, 34
returns from, 28
rewards of, 36
types—
animal specialty, 90
beef-cattle, 94
cash-grain, 86
cotton, 87
crop-specialty, 89
dairy, 90, 305, 360, 403
fruit, 82
generalized, 79
livestock, 90
part-time, 79
poultry, 97, 323, 406
truck, 80
wheat, 84

Farm Management, R. L. Adams, 21

Farm Management, A. Boss, 20

Farm Management, R. T. Hudelson, 21

Farm Management, W. J. Spillman, 21

Farm Management, G. F. Warren, 20

Farm Organization and Management, G. W. Forster, 12, 21

Federal cooperative credit agencies, 364

Federal Farm Mortgage Corporation, 365

Federal Land Bank, 364, 365

Federal Intermediate Credit Bank, 368

Feeding, efficiency in, 251, 293

Feed, animal, 327
condensing for sale, 149
converting to foods, 149
need for livestock, 184, 421
nutrients, 183
records, 343
supplies, 158

Fences, 168

Fertilizer, 155

Field arrangement, 163
access to farmstead, 164
fitting rotation to, 164
planning, 163
Fields, measuring, 471
number, 164
shape, 164
size, 164

Food, from farm, 320
preparation, 326
storage, 326

Forage crops, 149, 329

Fruit farming, 82
marketing, 412

Fruits, 321

GRAIN CROPS, 134
futures, 400
marketing, 399
measuring in bins, 475

Granary, ever-normal, 430

Grange League Federation, 392

Grass, 129
crops, 134, 149
pasture, 328

Grazing region, 61, 68

Great Plains, 31, 76, 85, 95, 132

Gully control, 145

HANDSCHIN, W. F., 17, 19

Hard Winter Wheat Belt, 61, 65

Hart, V. B., 21

Hatch Act, 5, 12

Hay Belt, 61, 66
production, 47
weight, 476

Hays, W. M., 13, 14, 15, 16, 18, 20

Hired help vs. children's help, 272

Hog inventory, 348

Holmes, C. L., 21, 74, 77

Home and farm supplies, 319
influence on the farm business, 274
projects, 101, 105
Homestead entry, 118

Hopkins, John A., 21
House, farm, 161, 302
Hudelson, Robert T., 21
Human element in labor management, 284
Human factor in farm operation, 268
Hunt, Thomas F., 13, 14, 18, 20

ILLINOIS AGRICULTURAL EXPERIMENT STATION, 12, 17
Implements, 310, 356
Income tax, 353
  record forms for, 354
Individual mortgage loan record, 367
Ingersoll, C. L., 12
Inheritance no advantage, 273
Insurance, against losses, 231
  company loans, 364
  fire, 378
  life, 379
  protection, 378
  wind, 378
Installment buying, 467
Intermediate Credit Banks, 365
Inventories, 236, 342, 348
Investments, protecting, 377
  returns, 240
Irrigated crop region, 61, 68

JOB ANALYSIS, 292
Joint account, 104
Joint tenancy, 440

KINLEY, DAVID L., 13

LABORATORY EXERCISES IN FARM MANAGEMENT, Warren and Livermore, 20
Labor, costs, 207
  efficiency in, 250, 276
    affected by size of farm, 279
    influence of operation, 280
  family, 278
  human element, 284
  management of, 232, 284
  productive and unproductive, 277
  records, 343
  simplification, 289

Land, 40
  classification of, 44, 46
  farming, 41
  forest, 42
  future needs for, 47
  grade distribution, 45
  grazing, 43
  pasture, 43
  productivity classes, 46
  quality, 44
  use, 41, 42, 46, 47, 146, 171, 428
Land O'Lakes creameries, 392
Law of comparative costs, 74
Law of regional competition, 75
Law, Von Thuenen's, 74
Lease contracts, 107
  cash, 111
  cash-and-crop-share, 109
  crop-and-livestock-share, 109
  crop-share, 108
  equities in, 112
  for completely equipped farm, 110
Legal matters, 433
  weights of commodities, 482
Lending agencies, 370
Life insurance, 379
Livermore, K. C., 20
Livestock, adaptation to farm, 157
  care, 159
  choice of, 247
  farming, 90
  feed supplies, 158, 421
  income from, 149
  in farm organization, 149
  management, 159
  market demands, 157
  marketing—
    concentration yards, 402
    direct buying, 402
  trucking, 402
  production, 158, 249
  ranching, 96
Loans, 364, 370

MACHINERY COSTS, 204, 233, 311
  efficiency in, 251

Management factors, affecting returns from crops and livestock, 253
applying analysis, 263
comparisons between farms, 256
selection, 252

Management of the Farm, The, L. A. Moorhouse, 21

Mapping the farm, 175, 471

Market, farm, 382
news, 334
price, 383
reports, 333
roadside, 336

Marketing, 332
butter, 404
cooperative, 338, 391
costs, 388
cotton, 408
dairy products, 403
direct, 403
fruits, 412
functions of, 385
grain, 399
handicaps, 332
improvements, 415
livestock, 157, 401
organizations, 380
potatoes, 411
poultry products, 406
problems, 332, 389
processing for, 386
storage requirements, 386
tobacco, 409
vegetables, 412
wool, 410

Measuring, a farm, 471
grain in bins, 475
hay stacks, 476

Meat products, 322

Minnesota Agricultural Experiment Station, 13, 14, 15, 17

Minnesota Secondary School of Agriculture, 14

Moisture conditions, 55, 127

Moorhouse, L. A., 21

Mortgages, 447
agencies, 365
chattel, 468
real estate, 365, 447

Mosher, M. L., 19

NATIONAL FARM LOAN ASSOCIATION, 366

Nationality influences, 271

Natural resources, 39
land, 40
soil, 40
water, 40

Nebraska Agricultural Experiment Station, 12

Negotiable instruments, 460
promissory note, 460

Net income, determining, 238

Net worth, changes in, 237

New York Agricultural Experiment Station, 17

Non-negotiable promissory note, 461

North Dakota Agricultural Experiment Station, 13, 15

OAT PRODUCTION, 47

Office of Farm Management, U. S. D. A., 18

Ohio Agricultural Experiment Station, 17

Ohio State University, 13, 14

Olmsted, Victor H., 16

Operation, elements of, 224
equipment for, 301
fundamentals, 226
human factor, 268
influence on labor efficiency, 280
measures of management, 242
measuring efficiency, 255
objective, 229
results, 236
timing, 233

Operator, responsibilities of, 224

Organization, functions of, 223
  influence on labor efficiency, 276
  of farm business, 245
Outbuildings, 302
Overdrafts, 466
Overton, M. H., 21
Ownership problems, 104

PARTNERSHIPS, 103
Pasture, 189, 327
Peck, F. W., 17, 19
Perishable products, 423
Personal property, 433
Planned production programs, 420
Plowing, 131
Pond, G. A., 20
Potato picking, 291
  marketing, 411
Potatoes, 321
Poultry farming, 97
  marketing, 406
  meat, 408
  products, 323
Power, 307
  animal, 219, 227, 308
  cost, 308
  efficiency in, 251
  electric, 310
  management of, 232
  tractor, 219, 227, 308
Production, areas, U. S., 54
  control, 390, 426
  control programs, 426
  Credit Corporation, 364, 365, 367
  efficiency, 249
  measuring, 175
  programs, planned, 420, 429
  protecting, 377
  rates of, 247
  records, 343
Profitable Farm Management for the Corn Growing States, L. S. Robertson and M. H. Overton, 21
Promissory note, 461

QUITCLAIM DEED, 440

RADIO MARKET SERVICE, 334
Rainfall, 56, 87
Ranching, 96
Real property, 374, 433
Receipts, cash, 342
Record books, farm, 344
Records, 103, 341
  cash, 346
  cost-of-production, 353
  farm procedure, 344
  feed, 343
  for income tax return, 353
  labor, 343
  miscellaneous, 344
  production, 343
Renting a farm, 459
Roadside markets, 336
Roberts, I. P., 13, 14, 18
Robertson, L. S., 21
Root crops, 329
Rotation of crops, 135, 193
  fitting to field arrangement, 164
  selection, 136
Rural Electrification Administration, 370

SEED-BED PREPARATION, 131
Shipping associations, 401
Shop, 318
Silage crops, 329
  weights, 481
Soil—
  conservation, 129, 144
    grass on rough land, 129
    gully control, 145
    strip cropping, 129, 145
    terracing, 130, 145
  Conservation Service, 144, 418, 428, 432
  distribution of grades, 45
  fertility, 61, 154
  management, 126
  maps, 175, 178
  quality, 44

Specialty farming, 89, 90
Spillman, W. J., 16, 18, 21
Spring Wheat Region, 61, 67, 86
State production programs, 429
Statistical routes, 16
Stock ranches, 96
Storage of foods, 326
Strip cropping, 129, 145
Substitution method, 213
Supply and demand, 384

TAPP, J. W., 20
Taylor, N. C., 17
Temperature conditions, 59
Tenancy, 107, 356
Tenant Purchase Act, 370
Tenants in common, 440
Terracing, 130, 145
Texas Agricultural Experiment Station, 12
Thermometer chart, 258
  interpreting, 262
  selecting factors for, 260
Thompson, E. H., 18
Tillage operations, 132
Title, abstract of, 437
Tobacco marketing, 409
Tomato picking, efficiency in, 290
Topography, influence of, 60
Tractor power, 308
Truck costs, 205
Truck farming, 80
Trucking to market, 402
Types of farming, 77
  classified, 78
  defined, 77
  requirements for, 78

U. S. DEPARTMENT OF AGRICULTURE, 12, 16, 17, 18, 129, 231, 355, 365, 415, 431
U. S. Patent Office, 12

VEGETABLES, 321
  marketing, 412
Von Thuenen's law, 74

WARRANTY DEED, 439
Warren, G. F., 14, 18, 20
Washington State College, 16
Water Supply, 307
Weed Control, 141
Weights and measures, 481
Weston, N. A., 12, 13
Wheat farming, 84
Wife's cooperation, 269
Winter Wheat Belt, 31, 61, 64
Wisconsin Agricultural Experiment Station, 17
Woodward, Carl J., 21
Wool marketing, 410
Work program, shaping, 276
  analysis of jobs, 292
  assigning jobs, 283
  calender, 280
  planning details, 283
  time and effort used, 286
Work simplification, 286
  barn arrangement, 299
  body motions, 287
  comparison of methods, 288, 290
  convenient layouts, 287, 299
  effective equipment, 287, 299
  methods, 289
  modifying the job, 288
  routines, 299

YIELDS, CROP, 248